# Decision Support in Contract Formation for Commercial Electronic Services with International Connection

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# Abstract

Electronic business in the Internet has become an important driver for economic growth. The provisioning of commercially offered electronic services in the Internet — *e.g.*, content, news, or social networking services — requires the conclusion of an international contract in case the respective service is provided across borders. In international contracts, two contractual parameters are of key importance: jurisdiction and applicable law. Jurisdiction indicates which state's courts are authorized to hear and decide on a potential contract conflict, while applicable law indicates under which state's law a court decision shall be found.

The way jurisdiction and applicable law choices are made in international service contracts today is often not compliant with the relevant provisions of Private International Law (PIL). Jurisdiction and applicable law terms are usually present in terms of choices made, but these choices may be illegitimate. Illegitimate choices are voided (and replaced by PIL-compliant terms) should a dispute arise and a contract claim be deposited in a court.

Given this risk and the imminent uncertainty outlined, service providers and customers alike need support in forming international service contracts. In particular, they need to know about jurisdiction and applicable law choices they can rely on. To date, however, there is no alternative available to the static, PIL-ignorant way adopted currently. This lack is perceived as a major hurdle to foster adoption of (international) electronic business.

Hence, in a pioneering effort to support service providers and service customers in international service contracting, a decision support system is developed. This system — named DeRISC (Dispute rEsolution Recommender for International Service Contracts) — produces a list of recommended jurisdictions and/or applicable laws during contract formation phase. Recommendations are determined in an automated and compliant manner according to the PIL-driven contract- and service-specific set of connecting factors.

This implies a number of challenges to be addressed, as there is considerable complexity in selecting the right PIL(s), modeling the accordingly relevant provisions, and implementing modeled laws in terms of a decision support system to produce jurisdiction and applicable law recommendations. In order to reflect and integrate different notions originating from different jurisdictions and their laws, a common information model basis is built. In the light of a method lacking to identify, select, and formally model the relevant legal basis, such a method is developed. In consideration of both, modeling method and information model, an implementation method is determined. Finally, an automated determination of jurisdiction recommendations is shown feasible and fully operational for the example of the main European PIL regulation modeled and implemented. The respective obtained results of an information model basis, a common modeling technique, and the implementation method constitute a cornerstone to facilitate increased predictability, legal certainty, and accurate risk assessment along the complete service and contract life-cycle for both contract parties.

# Kurzfassung

Elektronische Geschäftstätigkeit im Internet hat sich zu einem wichtigen Faktor wirtschaftlichen Wachstums entwickelt. Das Erbringen kommerziell angebotener elektronischer Dienste im Internet — z.B. Inhalts-, Nachrichten- oder Dienste sozialer Netzwerke — erfordert den Abschluss eines internationalen Vertrages, wird der entsprechende Dienst grenzübergreifend erbracht. In internationalen Verträgen sind zwei Vertragsparameter von zentraler Bedeutung: Gerichtsstand und anwendbares Recht. Der Gerichtsstand bestimmt den Staat, dessen Gerichte autorisiert sind, einen möglichen vertraglichen Streitfall anzuhören und zu beurteilen, währenddessen das anwendbare Recht den Staat bestimmt, dessen Gesetze massgeblich sind, um eine Entscheidung zu fällen.

Die Art und Weise, wie die Wahl des Gerichtsstands und des anwendbaren Rechts heute in internationalen Dienstverträgen getätigt wird, ist oft nicht mit den relevanten Bestimmungen des Internationalen Privatrechts (IPR) vereinbar. Vertragsbestimmungen zum Gerichtsstand und dem anwendbaren Recht sind zwar üblicherweise in Form einer Gerichtsstands- und Rechtswahl vorhanden, doch ist eine solche Wahl möglicherweise nicht zulässig. Eine unzulässige Wahl des Gerichtsstands respektive des anwendbaren Rechts ist rechtsunwirksam (und wird durch IPR-konforme Bestimmungen ersetzt), sollte es zum Streit kommen und eine Klage vor Gericht eingereicht werden.

In Anbetracht des erwähnten Risikos und drohender Unsicherheit bedürfen Diensterbringer und Kunde gleichermassen Unterstützung beim Schliessen internationaler Dienstverträge. Insbesondere benötigen sie zur Gerichtsstands- und Rechtswahl Informationen, auf die sie vertrauen können. Zur Zeit gibt es jedoch keine Alternative zum vorherrschenden statischen, IPR ignorierenden Weg. Dieser Mangel wird als bedeutsame Hürde für eine weitere Akzeptanz elektronischer (internationaler) Geschäftstätigkeit wahrgenommen.

Daher wird ein System zur Entscheidungsfindung als Pionierleistung in der Unterstützung von Diensterbringern und Dienstkunden im internationalen Dienstvertragswesen entwickelt. Dieses System — genannt DeRISC (Dispute rEsolution Recommender for International Service Contracts) — erstellt in der Vertragsabschlussphase eine Liste empfehlenswerter Gerichtsstände und/oder anwendbarer Rechte. Empfehlungen werden in automatisierter und rechtskonformer Weise anhand der Auswahl von IPR-getriebenen vertrags- und dienstspezifischen Anknüpfungsmomenten bestimmt.

Dies bedeutet, dass eine Anzahl von Herausforderungen angegangen wird, da in der Auswahl der passenden IPR-Normen, im Modellieren der entsprechend relevanten Bestimmungen und in der Umsetzung modellierten Rechts als System zur Entscheidungsfindung ein erhebliches Mass an Komplexität steckt. Um verschiedene Interpretationen unterschiedlicher Rechtsräume und deren Gesetze widerspiegeln und integrieren zu können, wird eine gemeinsame Informationsmodellbasis erstellt. Angesichts einer fehlenden Vorgehensweise zur Er-

mittlung, Auswahl und Modellierung der relevanten rechtlichen Grundlage wird eine solche Methodik entwickelt. Unter Berücksichtigung der Modellierungsmethodik und dem Informationsmodell wird eine Implementierungsmethode bestimmt. Schliesslich wird am Beispiel der massgeblichen modellierten und implementierten europäischen IPR-Verordnung gezeigt, dass eine automatisierte Bestimmung von Gerichtsstandsempfehlungen machbar und voll funktionstüchtig ist. Die entsprechend erhaltenen Resultate bestehend aus einer Informationsmodellbasis, einer gemeinsamen Modellierungstechnik und der Vorgehensweise zur Umsetzung markieren den Grundstein für beide Vertragsparteien zur Ermöglichung erhöhter Vorhersagbarkeit, Rechtssicherheit und präziser Risikoabwägung über den gesamten Dienst- und Vertragslebenszyklus hinweg.

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# Chapter 1

# Introduction and Motivation

Upon the conclusion of a contract between a service provider and a service customer for a commercially offered electronic service in the Internet, this contract is likely to have an international connection [106, 41, 84]. Provider and customer might be related by means of, *e.g.*, residence or citizenship to different jurisdictions. Also, the contracted service might have to be provisioned internationally. In case an international service contract has to be concluded, contract parties are well advised to agree at the time of contract formation on two key contractual provisions, namely those of jurisdiction and applicable law. Jurisdiction indicates which nation's courts are authorized to hear and decide on a potential conflict arising from a concluded contract [90, 86, 26]. Applicable law indicates under which nation's law a court decision shall be found [63, 21, 106, 37]. Jurisdiction and applicable law provisions, thus, might have a considerable impact on the risk assessment of an international service contract to be concluded [41].

The legal frame to be consistent with when determining jurisdiction and applicable law for an international service contract — or any international contract of civil and commercial matters — is laid out by the respective (national and supra-national) provisions of Private International Law (PIL) [25, 26, 37, 67]. PIL dictates to relate jurisdiction and applicable law to a nation according to the contract-specific set of relevant connecting factors. These connecting factors embrace facts which originate, on the one hand, from the respectively involved contract parties and, on the other hand, from the resulting contractual obligations.

## 1.1 Motivation

For commercially provided electronic services in the Internet, the (legally compliant) determination of jurisdiction and applicable law, and with that the set of connecting factors, is of key importance to both, a service provider and a service customer [106, 41, 84, 101]. First, commercial service provision asks for a contract to be concluded between service provider and service customer. Second, with the Internet being a global infrastructure [84], such a contract often will be an international contract [105]. Thus, jurisdiction and applicable law are of importance, in principle. Third, a contract has to be concluded before the actual service is provided. Accordingly, jurisdiction and applicable law need to be determined prior to service provisioning as well. Fourth, a contract of electronic service provisioning in the Internet falls under the category of a contract of civil and commercial matters [103, 100].

This implies that the respectively applicable PIL imposes, in principle, the procedures to determine jurisdiction and applicable law in relation to international contracts of electronic service provisioning in the Internet. Accordingly, the relevant set of connecting factors needs to be identified and used.

This, however, stands in contrast to the vast majority[1] of international service contracts concluded in the Internet today, in particular when focusing on consumer contracts between a professional service provider and a private service customer. Even though such contracts usually cover provisions on jurisdiction and applicable law, these provisions are typically static and unilaterally imposed in the sense that they do not consider the applicable set of connecting factors which — by standards of PIL — is supposed to be contract-, contract party-, and service obligation-specific. The typical static choice of jurisdiction and applicable law as of today might be in-line with the procedures imposed by PIL by coincidence; while there is considerable chance such a static choice is illegitimate. In case a contractual claim is deposited in court, one of the first things that court will do is to check whether any made choice of jurisdiction and applicable law is valid. This is to see whether that court is authorized to qualify the respective contract and, if it is, under application of what nation's law it shall qualify that contract [90, 86, 63]. If a court finds (by the application of the applicable PIL) that a choice of jurisdiction or of applicable law made is illegitimate, this choice is voided and replaced by the correctly determined jurisdiction and/or applicable law.

Consequently, the way jurisdiction and applicable law is handled in service contracts in the Internet today leads to a situation of uncertainty [72, 41, 105] for both, service provider and service customer. Both parties have to assume that choices made in a contract may be meaningless, *de facto* and *de jure*, as it was determined in a legally non-compliant way. This uncertainty will prevail as long as jurisdiction and applicable law are not determined according to PIL. This leads to the set of three identified conclusions motivating this work:

1. The uncertainty caused by PIL-ignorant choices of jurisdiction and applicable law made leaves a deep socio-economic impact on the overall acceptance of international electronic business in the Internet. It is seen as a major challenge to implement a single, harmonized regional (*e.g.*, European[2]) and international market for commercial electronic services. Service providers and service customers alike lack confident prospect that a concluded contract is qualified by a foreseeable set of authorized courts under application of a foreseeable set of applicable laws.

[1] This statement reflects consistent personal observation made in the process of assessing contractual terms of several commercially provided electronic services in the Internet. It is not quantified by means of empiric data gathered in an embracing study. Nonetheless, it bases on a strong assumption. Not even a single case is known at the time of writing for which an international service contract with a consumer would have foreseen a dynamic, mutual, and PIL-conforming determination of jurisdiction and/or applicable law clauses at the time of contract formation.

[2] Legal uncertainty has been identified and communicated by the European Commission as a key judicial issue to be addressed in the accordingly developed Action Plan Implementing the Stockholm Programme [32]: "*Cross-border transactions can be made easier by increasing the coherence of European contract law. Businesses are not taking sufficient advantage of the internet's potential to boost sales: Union law can help by increasing businesses' need for legal certainty and at the same time guaranteeing the highest level of consumer protection. Consumers need to be aware of their rights and provided with access to redress in cross-border cases.*"

2. In the absence of a methodology to facilitate and document the identification of the relevant PIL(s) and the accordingly applicable set of connecting factors, and in the absence of a decision support system to facilitate and automate the legally compliant determination of jurisdiction and applicable law recommendations, all that service providers and service customers can do today is (a) to assess the risk of a dispute in the first place, and (b) to develop a strategy where to deposit a claim. Both, however, requires the assistance of jurists[3] which may raise a significant burden to SMEs (Small and Medium-sized Enterprises) and consumers, given the uncertain situation outlined.

3. Consequently, this methodology and the respective decision support system need to be developed. The accordingly available legally compliant determination of jurisdiction and applicable law recommendations is expected to foster informed choices of providers and customer, while it is expected to lead to an increased use of innovative services.

Hence, the problem to be solved is to determine in an automated and PIL-conforming manner recommendations on suited jurisdiction(s) and applicable law(s) for an international service contract to be concluded. Those three identified challenges of a common information model, modeling method, and implementation constitute necessary contributions to this problem.

## 1.2 Claims and Objectives

Driven by the motivation outlined, this thesis addresses the following claims:

**Claim 1: Trust-building in international electronic business** — Overall, this thesis aims to foster trust of service customers and service providers in international electronic business. Lack of trust is seen as a major hurdle to wider adoption of commercial electronic service provisioning and to implement harmonized markets. Within the frame of this thesis, trust-driven issues related to jurisdiction and applicable law provisions are envisioned exclusively. Accordingly, this claim is referring to the accordingly derived claims 2 to 4.

**Claim 2: Increased legal certainty in international service contracting** — Service providers and service customers are confronted with legal uncertainty in international service contracting — in particular when it comes to enforcing a contract across borders. For successful contract enforcement, a diligent determination of jurisdiction and applicable law at the time of contract formation is essential, since these two contractual provisions indicate in which nation's courts and under application of which nation's law any potential conflict arising from the respective contract is treated. This thesis aims to ease and automate the process of determining recommended jurisdiction(s) and applicable law(s) so that service providers and customers can rest assured that the international service contract they concluded is enforceable at the place and under the law they both agreed to.

[3] See objective 1 in Section 1.2 for a delineation between foreseen automation during contract formation phase for a list of recommendable jurisdiction(s) and/or applicable law(s), on the one hand, and any potential human interaction in court during contract enforcement phase, on the other hand. The latter is not targeted in any way here.

**Claim 3: Legal compliance in determining jurisdiction and applicable law** — The issue with jurisdiction and applicable law is not that these two contract parameters would not be included in international service contracts today. The issue is that provisions on jurisdiction and applicable law are often illegitimate — in particular, in case of international service contracts with consumers (in terms of private customers). This thesis aims to help overcome unlawful provisions being taken as it respects those rules imposed by PIL to determine jurisdiction and applicable law in a legally compliant way.

**Claim 4: Risk assessment due to informed choices and PIL awareness** — This work aims to sensitize service customers and service providers to chances and risks related to international service contracting. It, thus, seeks to abstract away those manifold details in the process to determine jurisdiction and applicable law, while focusing on asking only relevant information from service providers and service customers. This focus on complexity reduction enables service providers and service customers to conduct an assessment of risks involved with the conclusion of an international contract. Such a risk assessment is of particular importance to institutions and persons which are characterized by limited contract negotiations power and constricted knowledge in law of relevance to international contracting.

Those four claims mentioned translate into the key set of specific objectives. These objectives are concerned with the design, implementation, and testing of DeRISC (Dispute rEsolution Recommender for International Service Contracts), a decision support system that facilitates automated determination of recommended jurisdiction(s) and applicable law(s) for international contracts in relation to electronic services in the Internet in a legally compliant manner:

**Objective 1: Automation support** — Jurisdiction and applicable law recommendations have to be determined in an automated, *i.e.*, machine-executable way during contract formation phase. The legal basis to be compliant with in questions of jurisdiction and applicable law is determined by PIL. Thus, the primary object of automation is PIL legislation. Automation based on a legal source is challenging, since laws typically are not designed for automation. For the automation objective of the thesis at hand, the following sub-objectives are implied:

**Result in terms of recommendations** — Automation results in a list of recommendations. These recommendations are intended to signal suited jurisdiction(s) and applicable law(s), whereas it is up to the accordingly involved contract parties whether or not to consider these recommendations.

**Adherence to law** — Recommendations have to be determined under consideration of the PIL-driven set of procedures[4] and the respective set of relevant connecting factors[5].

[4] PIL is part of procedural law (as opposed to material or substantive law).

[5] Automation covers steps to identify the relevant set of connecting factors as well. However, it does not cover the acquisition of the actual connecting factors from a service provider and a service customer. Acquisition is simulated.

**Scope of contract formation phase** — PIL addresses typically jurisdiction and applicable law from an *ex post* perspective during contract enforcement phase in court. This thesis, on the other hand, adopts an *ex ante* perspective (recommendations[6] during contract formation phase). Therefore, PIL provisions need to be time-wise ported to the level of knowledge available in contract formation phase.

**Objective 2: Integration of different national and supra-national PILs** — There is not a single PIL, but several national and multiple supra-national PILs. Depending on a specific international service contract to be concluded, the relevant PIL needs to be identified before it can be modeled and implemented. This thesis aims to consider PILs of national and supra-national relevance in an integrative manner. Integration covers a common terminology, a common information and work flow model design, and common thematic focuses.

**Objective 3: Business-to-Consumer (B2C) and Business-to-Business (B2B) support** — PILs often differentiate between international contracts that involve professional providers and professional customers from international contracts that involve a professional provider and a private customer, a consumer. Both cases shall be investigated and fully supported, since both schemes are perceived equally important.

**Objective 4: Scope of international service contracts** — This thesis considers exclusively provisions of PIL relevant to the international, commercial, and electronic provisioning of services. However, information model, modeling method, and implementation technique are supposed to be extensible so that application to similar international service contracts may become possible in the future.

**Objective 5: Scalability by means of complexity reduction** — With every extension aiming at wider geographic (objective 2), electronic business scheme (objective 3), and service contract (objective 3) application, the respective set of relevant legal basis, required connecting factors, and implementation specifics is expected to grow. Scalability is ensured by means of complexity reduction through abstraction. This relates to an adopted focuses on standard cases, whereas exceptions and reservations may be abstracted.

This set of claims and objectives determined depicts the interdisciplinary nature of this thesis. Claims and objectives typically require a study and the respective impact being made from both a legal as well as a computer science perspective. The primary computer science impact envisioned is summarized in exploring and pushing boundaries of automation based on an unstructured, not (technically) specified, highly complex, and human interpretation-oriented set of rules. This impact shall be made by extending and applying methods of Service Level Management, the development of suited information concepts and artifacts, and the use of logic programming in rule-based expert systems. The set of claims and objectives constitutes the applicable realm for an overall assessment of results obtained and insights gained throughout this thesis. Such assessment is conducted in Chapter 8 in terms of a qualitative analysis.

[6] By adopting an *ex ante* perspective, automation is by no means supposed to emulate or even replace any human action in court. Automation models and, thus, follows PIL procedures, but it focuses on the contract formation phase exclusively, not on any potential dispute arising out of contract.

## 1.3 Thesis Outline

Chapter 2 provides a comprehensive overview of relevant background information and existing work in the area. This embraces a definition of scope based on economic, technological, and legal dimensions. Driven by an outline of legal traditions established world-wide and the resulting domain of conflict of laws, emerging issues in PIL and the Internet are introduced. This perspective is complemented by an embracing discussion of contract formation, electronic contracts and services, and PIL issues in international service contracting. Subsequent to an overview of decision making support, the set of accordingly identified gaps is documented and preliminary conclusions are drawn.

Chapter 3 denotes the set of key challenges determined and derives the scientific approach chosen. This covers a three-step law modeling and implementation methodology defined, the overall design science approach adopted, and the methodology applicable to the international service case study of Chapter 4.

This case study reflects a real-world service offering with a dynamic bandwidth feature. After an introduction to the relevant technological background, various contract constituent parts are outlined and analyzed including applicable SLA parameters. This provides for grounds based on which service provider and service customer obligations are determined and the applicable contract nature is discussed. This case study, thus, offers insight into a complex international service and contract construct from a practical point of view. A deep going understanding of how to qualify international service contracts is perceived essential due to an overall focus on automated determination of recommendations for an international service contract to be concluded.

Based on the case study investigated and the respective insight into international service contracts gained, the accordingly developed information model is introduced in Chapter 5. This information model serves as a common ground for the PIL modeling method and the implementation method, respectively. The information model consists of a concept model and an artifact model. Artifacts reflect connecting factors of relevance to an example PIL analyzed. The concept model is based on an established information model in service management which has been largely extended in order to match the respective characteristics of an international service contract. Hence, the information model developed covers dimensions of service and contract management.

Chapter 6 is concerned with this focus directly as it presents the comprehensive method defined to identify, select, analyze, and formally model PIL sources. Guidelines for PIL identification and a set of law selection criteria are provided. For PIL analysis, criteria for inclusion or exclusion of any given law provision are listed and motivated. This is complemented by a detailed discussion of how to model a selected and analyzed PIL source as an activity diagram. All methodologically described steps are applied to a specific example PIL source.

Driven by both, the formal model of a PIL and the information model determined, Chapter 7 addresses the implementation of modeled PIL sources resulting in the decision support system DeRISC to produce jurisdiction and/or applicable law recommendations. This includes details on system design decisions and on a common implementation method developed. All parts of the implementation method are fully documented and applied to the same example PIL source modeled in Chapter 6. By means of the relevant set of test cases,

a functionality evaluation is performed. This is followed by an in-depth discussion of model and implementation results obtained.

Chapter 8 finally summarizes the work conducted and draws overall conclusions. The latter involves qualitative considerations on achievements made in relation to those claims and objectives raised initially as well as in relation to those gaps identified in Chapter 2.

# Chapter 2

# Background Information and Related Work

Since directly related work in the sense of comparable approaches, efforts, or implementation work is scarce, and since this thesis addresses a complex and interdisciplinary topic, this chapter provides an overview of important thematic areas touched. In particular, background information is outlined to allow a better assessment of this work's focus and impact. To that aim, the detailed scope definition adopted is introduced. According to this scope definition, all subsequent sections provide insight into select, particularly relevant areas of interest in a fine-granular manner. This chapter's aim, hence, is four-fold: The distinct scope of work shall be defined, key terminology and important notions of mechanisms from a technical and legal point of view shall be known, state-of-the-art — where available — shall be presented, and gaps shall be identified and documented.

## 2.1 Scope Definition

A decision support system to produce a list of jurisdiction and applicable law recommendations in an automated and legally compliant manner touches thematic dimensions of both, law and technology. Legal compliance is a requirement from the former, automation is a requirement from the latter dimension mentioned. Law determines the frame to be consistent with, while technology reflects available implementation options. In other words, this thesis is concerned with a research problem which is legally driven and for which a suitable technological solution shall be found. Figure 2.1 shows and relates dimensions of law and technology accordingly.

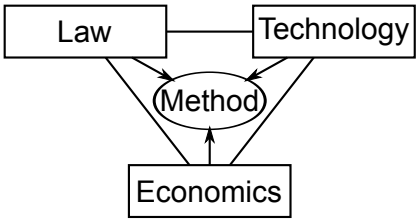


Figure 2.1: Principle Thematic Dimensions Touched

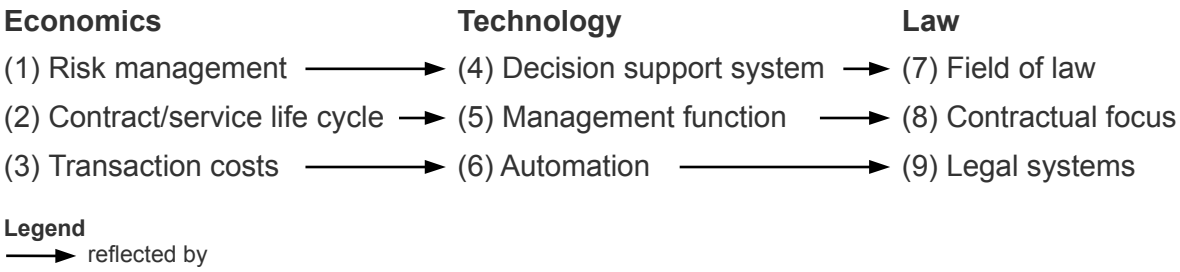


Figure 2.2: Scope and Inter-relations per Thematic Dimension

In addition to law and technology, Figure 2.1 introduces a third dimension, that of economics. This dimension shows relations to the other two dimensions. Whichever legal basis is to be considered and whatever solution paradigm technology may offer, the overall undertaking is worthwhile only if core economic principles are respected. This implies, for instance, that a risk assessment is facilitated for service providers and service customers and that transaction costs in international service contracting are bounded.

These three principle dimensions addressed so far, hence, are mutually inter-related. Moreover, each dimension influences directly one of the core results of this thesis, namely the method developed to identify, analyze, formally model, and implement a PIL. Consequently, this method has to reflect legal, technological, and economic requirements and limitations.

For the dimension of economics, this work was motivated by the contract parties' need identified to make informed choices and to be aware of PIL-oriented issues when concluding an international service contract. In other words, a service provider and a service customer shall be enabled to assess the risk involved — at least with respect to jurisdiction and applicable law. Accordingly, risk management is listed for the dimension of economics in Figure 2.2 as an area of scope to be discussed in this chapter. Such risk assessment is addressed from a technological point of view by means of the DeRISC decision support system, (4) in Figure 2.2, producing recommendations on suited jurisdictions and applicable laws. As DeRISC is specific to PIL-driven questions, the respective field of law (7) of PIL falls within this thesis' scope definition and it shall be introduced in this chapter.

However, any risk assessed (1) becomes inherently meaningful only, if it incorporates potential and risks from all phases of a contract and service life cycle (2), respectively. This is mainly due to the fact that jurisdiction and applicable law recommendations shall be made available during contract formation while these recommendations shall signal jurisdictions/applicable laws that have a good chance to be accepted by a court should — later on — a dispute arise from that contract and should that dispute be brought to a court. Hence, the life cycle of a contract and of a service are both with this thesis' scope so that they shall be explained here.

From a technological perspective, contract and service life cycles need to be reflected, in particular with respect to a common information model basis, by means of the set of key concepts and information artifacts suited for the management function (5) of both, IT Service Management (ITSM) and contract management. Especially for an understanding of the latter the specific contractual focus (8) to find application within the frame of this work has to be introduced and differentiated.

As long as jurisdiction and applicable law recommendations determined are of value to contract parties — be it to increase risk awareness only, be it to help risks of long-arm jurisdiction — chances for bounded or even lowered transaction costs (3) along a complete contract/service life cycle prevail. The level of transaction costs for a given international service contract to be concluded depends on the value added by automation (6) in identifying recommendations, on the one hand, and on the complexity and effort needed to cope with PILs and specifics from different legal systems (9), on the other hand.

## 2.2 Legal Traditions

Several legal systems have emerged in different regions of the world. These systems typically follow their own characteristic tradition which renders an integrative view on global law more difficult. Comparative law is the field in law that documents and differentiates systems of law.

Several structuring approaches prevail in comparing different legal systems and traditions. Seven legal traditions are presented by Glenn in [43]. This classification approach is a comparably detailed one — which is the main reason for presenting legal traditions here according to this source. Classifications of other approaches, for which the one by JuriGlobe promoted in [59] is mentioned exemplarily, correspond typically at least in major parts with Glenn's classification.

Figure 2.3 shows a partial mapping of these two classification approaches mentioned. This mapping reveals that [43] is following primarily a historic structuring principle. This finds expression in the order of legal traditions listed and in the fact that legal traditions are emphasized instead of currently observed law systems. The latter is a viewpoint of relevance to [59] as it emphasizes law systems which are prevailing as of today in either a single predominantly found form or in mixed forms. Accordingly, JuriGlobe's approach is especially suited for attribution of legal systems to United Nations member states as presented in [60] and for geographical visualization of legal system distribution across the globe [58].

Sections 2.2.1 to 2.2.7 summarize those seven legal traditions as described in [43] with their main characteristics. The order is consistent with the source and as presented in Figure 2.3 (*cf.* legal traditions according to Glenn). Section 2.2.8 inter-relates different legal traditions with respect to mutual compatibility and potentially conflicting aspects. Section

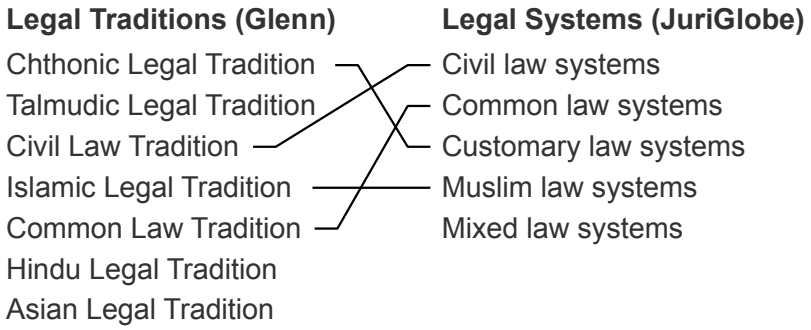


Figure 2.3: Partial Mapping of Legal Tradition Classification According to Glenn [43] with Legal System Classification According to JuriGlobe [59]

2.2.8, accordingly, introduces the term and field of conflict of laws. Conflict of laws is a near-synonym to PIL. Consequently, an understanding of conflict of laws is essential, as PIL constitutes the field of law of interest.

### 2.2.1 Chthonic Legal Tradition

The chthonic legal tradition emerged in regions where people live in close relationship with the earth. It finds its origins in internal considerations, thus, law is not seen as externally imposed. Chthonic law appears to be the oldest system, finding a tradition as long as human history. It was preserved mostly in non formalized way, passed from one generation to another orally or by means of ceremonies and techniques of life. For that reason, orality, informality, and consensus are seen as the three key attributes of chthonic law. Legal institutions typically comprise councils of elders, sometimes supplemented with chiefs, while there are no formal courts. The latter has important implications in the area of private criminal law. Dispute resolution takes place between clans not between individuals.

Chthonic law does not know any barriers of cost or barriers of permission so that dispute resolution is openly and immediately available. It is close to so-called substantive law in the sense that it is immediately applicable. In contrast to other legal systems, and especially western law, chthonic law hardly covers any law of obligations. Particularly with respect to land, the concept of individual ownership is not fully supported. Technology is seen as a potential threat to a life in harmony with earth and it has to be limited if a specific technology is attributed a destructive character.

### 2.2.2 Talmudic Legal Tradition

The Talmudic legal tradition emerged in the Jewish community. It is religiously inspired, constituted as divine law. Its origins are found in Jewish religion at God's revelation to Moses. Therefore, the Old Testament forms the core of Talmudic law in the form of the Torah or more specifically the Pentateuch (the written Torah). Talmudic law has both, an oral as well as a written tradition. Over time, the oral tradition was written down too, resulting in the Mishnah. The Mishnah, in turn, was interpreted and commented over time which lead to the Talmud that incorporates the commented Mishnah. While the (written) Torah dates back to the thirteenth century BC, the Talmud was started around a century before Roman emperor Justinian's time. The Torah and the Talmud are complemented by a row of codes, further commentaries, and responsa that comprise written opinions expressed by rabbis.

The Talmudic tradition is characterized by the sources it relies on but not by jurisprudence. It applies to Jewish community members irrespective of location. Even in secular states, but typically limited to personal law and mostly in family law matters, rabbinical courts can be established. Regarding institutions, Talmudic law knows formal courts and high courts, the latter being responsible for capital offenses, besides Grand Sanhedrin which regulates matters of wide implications for the whole community. There is no system for appeal implemented. However, the same court remains available to correct a judgment under certain circumstances. The Sanhedrin can be invoked by non-Jewish parties if the other party is Jewish as an alternative to civil law.

Talmudic law covers all areas of western private law, in particular with regard to commercial law. Judgments are not of formal state authority, however. This is different in the

state of Israel where Talmudic law is directly applied, but only in matters of personal status and family law. In the same sense as in chthonic law, Talmudic law is openly available and substantive (as opposed to procedural law), whereas the concept of private property is fully established.

### 2.2.3 Civil Law Tradition

The civil law tradition roots in the principles of Roman law. After that the (western) Roman empire had collapsed in 476 AD roman law's predecessor, chthonic law, replaced Roman law again in wide regions of the former empire. Modern continental civil law bases on roman law as it has been re-discovered in the eleventh century AD. In contrast to chthonic and Talmudic law, civil law is created. This was achieved on the one hand by invoking formal legal institutions, courts, and on the other hand by the process of codification — the most famous codex being the one of (eastern) Roman emperor Justinian finished in 533 AD.

Courts were originally not openly available. There was a long procedure to be followed which was finally overruled by directly seizing the judges in the late years of the Roman empire. Around the same period a system for appeal was introduced, too. Traditionally, judges were amateurs, patricians, while access to the court was controlled by a professional, the praetor. By abandoning access barriers, Roman law made a move from procedural to substantive law.

The codex was written by professionals, traditionally by priests that were called pontiffs and later on by jurisconsults. These were not allowed to decide in legal matters. Their task consisted in giving legal advice, similar to responsa in Talmudic law. And so were the legal domains that Roman law covered. These were concerned mostly with family and commercial law. In contrast to the Talmudic tradition — the Talmud is not seen as completed but as an ongoing process — Justinian's codex was prohibited to be commented.

With the rise of universities that had theological and legal faculties as their main domains, Roman law was studied in co-existence with Christian church law (canon law). Those studies formed the basis for a substantive law that was adopted in continental Europe (and Scotland) in the 16th century. This reshaped Roman law is referred to as *ius commune* which, however, needs to be differentiated from common law. *Ius commune* built the basis for diverse national civil codes founded in the 19th and 20th century in continental Europe and South America, thus, for what is called in English speaking countries civil law.

Civil law is characterized by the principle of rationality which roots in the humanist tradition. This is expressed exemplarily by separation of church and state in most civil law jurisdictions. Another example is the technical and abstract style of writing in civil codes. In humanism, the individual is in the focus. Accordingly, civil law incorporates the shift towards privatization. For that reason, individual ownership became the only form of ownership while communal ownership became even prohibited. With this subjective angle at law come individual rights. This is in contrast to the Talmudic tradition that covers mostly obligations but not rights. Rights are granted irrespective of status or birth which determines a fundamental concept of western civilizations. Rationality means also logic so that civil codes are a construction of logical reasoning. Driven by what is commonly denoted as positive law — the idea that both, the world as well as the law can be changed — a revolutionary tradition was established in civil law. Many of those mentioned base concepts are represented in civil

as well as in common law. These two legal traditions, thus, share similar ideas so that they are commonly subsumed under the term of western law.

### 2.2.4 Islamic Legal Tradition

The Islamic legal tradition is religiously inspired. It dates back to the revelation of Allah to the prophet Muhammad in the sixth century. At that time and region — today's Saudi Arabia — all characterized legal traditions so far were known, at least in their original form. The Islamic revelation differs from the Jewish and Christian revelation in the sense that it took place in a word-by-word manner over a period of several years. The revelation is, thus, contained in full detail of more than 6000 verses in the book Koran.

The Koran forms the main resource in the Islamic tradition. In analogy to the Talmudic tradition, the Koran is complemented by other sources. While the Talmud is an interpretation of the Torah, in the Islamic tradition all other resources depend on the Koran. The complete collection of Islamic law is called the Shari'a. Besides the Koran, there is the Sunna that contains the prophet's conduct in living and explaining the Koran. Thus, the Sunna embraces traditions, each represented in the form of a hadith. As a third element in Islamic sources, ijma reflects religious consensus as it prevails in different Islamic movements. In the same way the Sunna is subordinated to the Koran, ijma is subordinated to the Sunna. The fourth, again subordinated, element of Islamic law is qiyas. Qiyas is not seen as a legal source itself, but rather as a source of law that is achieved by individual reasoning in the form of analogies.

Dispute resolution is achieved by a qadi, the judge, in a so-called law-finding trial procedure. Each case is seen as particular and it is the qadi's charge to find the specific law that is appropriate to be applied in that case. In a process, emphasis is put on oral testimony whereas written evidence is taken into account in exceptional cases only. The qadi's decision is provided without any written reasons. Consequently, and in contrast to the common law tradition, Islamic law does not know the idea of precedents. Further, there is no system of appeal nor are supreme courts implemented. A decision can be adapted by the deciding qadi only. Legislation is not institutionalized as such. Similar to the Roman jurisconsult, however, a mufti can support the court with opinions (fatwa) which is perceived as a driver for Islamic law development. The Islamic tradition, thus, has another relation to the concept of states as it is the case, for instance, in western law.

While in family law, in particular with respect to marriage and adoption, western and Arabic law conflict in some areas, more parallels are found in commercial law, such as in the recognition of private property. As commercial law incorporates more ethical considerations in the Islamic tradition, unjust enrichment — interests fall in this category — is explicitly forbidden. In the same way, personal liability cannot be limited to corporate assets and some insurance contracts are not accepted in Islamic law. Overall, Islamic law constituted by the Shari'a covers the full range of determinations in law and moral — two concepts that are perceived as a unity.

In some Islamic states the Shari'a is the law of the land, but where it is not, two models can be differentiated. In the first model, Islamic law is provided as a personal law formally accepted for the Islamic community. The second model is applied in states that prohibit the existence of personal laws. This is the case in most western states, supported often by the

separation of state and church. In this model, religious courts may still be invoked as private tribunals for community members.

### 2.2.5 Common Law Tradition

The common law tradition — expanded in many forms to large parts of the world as a consequence of colonization — emerged around a century and a half after that the Normans had invaded England in 1066. The Normans were interested in a legal system that strengthened Norman power, yet being adopted and trusted by local inhabitants. This role was consequently attributed to priests that were at that time already educated in canon and also civil law. In addition, locals were granted the right to act as sworn. The royal (Norman) court system proved to be more efficient as other competing institutions for both, the Normans that were able to control judges as well as for inhabitants that gained from faster and more reliable jurisdiction than before. With the renaissance of Roman law in Europe at the same time, common law was inspired by some of the same tendencies.

Judges in the common law tradition were professionals, but the process of law-finding was performed by amateurs, the jury. Access was not open as a screening procedure was in place for cases and complaints. Legal professionals were educated at the Inns of Court, institutions that were originally bound to the church.

The instrument that allowed a case to be taken to a royal court is called a writ. Writs are formal commands by the Crown addressed to a royal officer, containing instructions on the procedure to be followed. Common law procedures, thus, were determined by the system of writs, rendering common law to a procedural system. It was the judge's charge to decide on whether a case fell under a specific writ, but it was not the judge's task to decide in substantive terms in a given case — substantive decisions were in the exclusive domain of the jury. In order to win a case, on the one hand all requirements of the appropriate writ had to be satisfied, while on the other hand the jury had to be convinced in substantive matters. Thus, judges focused on the more generic rules of common law. Since the jury's decision was assumed by its nature to be non-erroneous there was no system of appeal implemented. Over time, the system of writs spread to nearly all fields imaginable (except from family law), making it highly complex.

The system of writs limited the range of common law. Along with common law, chthonic, feudal, and ecclesiastical law were still applied. The fact that common law left room for coexistence with other traditions is the reason why there is still today a law of torts which governs aspects of commercial law. In common law, land is *de jure* not owned but held, *de facto* this comes to a similar result as private ownership. Further, common law knows the concept of precedent. These determined, however, a law system that was still alterable so that inconsistencies prevailed in many areas. As a tradition of law of obligations, common law does not support directly the concept of subjective rights.

In the nineteenth century, several reforms took place in the common law tradition. First, access to courts was opened by abolishing the need of being granted a writ from the chancellor's office. Second, open pleading (fact pleading) replaced the formal procedure of having the pleading party to explain the arguments based on what this party would see to win the case — notably before all the facts were known in the case. Opening access and allowing for pleading in all matters rendered consequently the status of the jury from mandatory to

optional. The judge, thus, also had to decide now in substantive matters, while the jury was only invoked exceptionally in civil cases[1]. With the judge deciding in substantive matters and the lowered status of the jury, the need for a court of appeal became apparent, leading to its introduction in the same century. Finally and driven by the rising idea of positive law, common law became more systematic by establishing a common law philosophy, by judges being bound on the one hand by pre-existing law while making it possible for them on the other hand to make law. Those changes in the nineteenth century brought common law and continental law closer to each other. Given those similarities, common and civil law are subsumed commonly under the term western law.

### 2.2.6 Hindu Legal Tradition

Similar to the Talmudic and the Islamic tradition, the Hindu legal tradition is religiously inspired. It finds its roots in a series of sources, the Vedas (the revelation), the Smriti and the dharmasastras (explications), as well as a row of detailed commentaries. Dating the Vedas is controversial and estimations vary from 2000 to 1500 BC up to 4000 BC. Accordingly, the Vedas are not attributed to one author or to a known group of authors. Education in the Vedas was performed by the Brahmans. Since Brahmans taught mostly from memory they used a system of notes that contained the main ideas. Such a mnemonic is called sutra. Most of them were written around 800 to 200 BC. Written tradition is termed the Smriti, developing over time further into more fine-grained textbooks, called the sastras. The latter date back to the period between 200 BC to 400 AD. There are three books of dharmasastras, covering a vast area of legal concepts, reaching until civil law determinations. The sastras were commented in further detail in the time from 700 AD to 1700 AD. Commentaries and digests were written as private works which makes Hindu law in its classic sources inofficial law without status of authority.

Hindu law incorporated a system of people courts led by the main royal court, the Sabha. Subordinated courts comprised the Kula (family court), the Sreni (commercial court), and the Puga (village and community court). Appeal took place in the order of court hierarchy, starting at the Kula, going to the Sreni, the Puga, and finally to the Sabha. There were, however, no written reports, nor was there a notion of precedent. Hindu law was substantive as there were not any known procedural barriers.

Most of classic Hindu law's sources are nowadays obsolete and have been replaced by what is called Anglo-Indian law. Despite that, the ideas of karma (determined by what an individual accomplishes good in a lifetime), dharma (determined by the obligations and rights according to an individual's place in society) and the resulting lack of equality reside still today in Indian society. Under the influence of British colonization in the nineteenth century, most parts of Hindu law were codified in terms of the common law tradition. Most notably the complete Hindu law tradition with regard to commercial law has been replaced by common law. Only the law of family and succession remained from the Hindu legal tradition.

[1] The jury's status is different in the US due to constitutional protection.

### 2.2.7 Asian Legal Tradition

The Asian legal tradition — as diverse it might appear — shows some common ideas. Religion has only a small footprint in law, making Asian law similar to western law. Confucianism which is not a religion traditionally has a high normative influence while religions such as Buddhism, Taoism, or Shintoism deal with aspects that are not seen as part of legal systems.

Confucius was a philosopher of what is known as the li in the sixth and fifth centuries BC. The li embraces the general normativity of the Confucian society. It is complemented by fa which determines the formal side of law and in particular criminal conduct. In the Ch'in empire that was established in 221 BC fa was the main means to ensure public order. With the fall of the Ch'in empire that lasted for some years only and that was characterized by repression by means of fa, its successor, the Han regime, made the li and thus Confucianism the official doctrine. Yet the existing fa books of punishment remained with a certain status and were used in parts until 1911 when the last dynasty (Ch'ing) ended.

Over time, the codes were refined and extended, covering wide areas of administrative and criminal law. Private law issues were, however, fields of the more general li, thus, Confucianism. Due to its orientation towards administrative law, magistrates were given the full range of roles from investigator to judge. Outside China, Confucianism had most influence in Korea, Japan, and Singapore.

Asian law, in particular Confucian systems, embrace formal law only in the domains of administrative and penal law, whereas private law is mostly absent. This holds true from a formal perspective only, however. The li — in principle a collection of moral law — covers also private law. Confucianism does not know the concept of individual rights, whereas inequality is acknowledged, even though it needs to be overcome or at least justified. Lack of formalism left room for importing capitalist and communist law. This so-called process of westernization brought German, French, and Dutch civil codes to Japan, China, and Indochina in the time of colonization. US and English common law in turn influenced mostly Hong Kong, Malaysia, Brunei, Singapore, and the Philippines. Influence of western law, however, did not endure in all areas for a long period. In particular in China, civil law lost much of its influence by the late 1940's. At that time, socialist law succeeded in the Soviet Union, in China, North Korea, and Vietnam.

### 2.2.8 Conflict of Laws

The characterization given of those seven major legal traditions visualizes that full integration — and be it only for specific sub-areas of PIL — is hardly achievable. This issue prevails in traditional cases as much as it becomes apparent when considering electronic service provisioning in the Internet. Due to the Internet's global reach the chance for situations where legal traditions collide in an incompatible is even raised. It is the concern of conflict of laws, often used as a synonym for PIL, to decide on what jurisdiction applies in a specific case.

As with respect to chthonic law, the situation becomes less pressing since pure chthonic traditions do not exist anymore [43]. First, chthonic law has mixed in some ways with western and Islamic traditions, mostly due to colonization. Secondly and often as a consequence of the latter, chthonic peoples today live within states. This results in potential incompatibil-

ities between a state's citizens and its institutions, but relieves pressure from difficulties in private international law matters.

Regarding the relation between western and religious law traditions, integration of Talmudic law and western law systems, namely civil law and common law, appears much less ambiguous — at least in matters of obligations since Talmudic private law covers all areas of western private law and even supports the right to choose the legal system that applies to a specific contract (in western terminology choice of law) [43]. This goes even that far that an individual choosing Talmudic law becomes Jewish and the opposite way round, the latter being more controversial than the first.

In a similar way as for Talmudic law, Hindu law appears well integrable with western law in the area of commercial law. As a matter of fact, integration has been achieved already — at least officially — by simply replacing Hindu commercial law by the one of the common law tradition in the period of British colonization. Through the same mechanisms of adopting western or socialist law, the Asian legal tradition integration shares many concepts of PIL. Some directly, such as in Japan, some indirectly, such as socialist China. Socialist law is in principle compatible with PIL — with certain adaptations needed. So is public law much higher weighed as private law, and in private law, many instruments are replaced by public replacements. In the most areas of the former Soviet Union, there is today even civil law.

Islamic and western law show certain parallels, in particular in the area of commercial law. Yet integration of the Islamic with the western legal tradition is more challenging as with respect to integrating western and Talmudic law in commercial matters. Especially the different notions of jurisdiction, individuals, and states appear as potential sources of conflict.

Overall, the potential of unresolvable conflicts of laws is fully acknowledged. It is valued as a general open issue in the legal domain that this thesis needs to be fully aware of whereas it is not the task of this work to determine a solution to it in the most general way. [43] concludes as "*The answer would appear to be that there is no such universalizable core. This is good news for the sustainability of the major, complex, legal traditions of the world.*" Accordingly and as a matter of last resort, commercial electronic service provision might be declined at all under unresolvable conditions. The approach of Roman law which separated into two branches, *ius civile* applicable to Romans and *ius gentium* applicable to non-Romans, is by no means a solution to conflicts of laws in the Internet. Simply ignoring such conflicts is not feasible in a global construct. It would only be feasible if there was a globally accepted, specific Internet law that could be separated from existing legal systems.

While the analysis of different legal traditions reveals and acknowledges a risk of unresolvable conflicts, the analysis shows as well that a fundamentally similar perception of commercial law is established in many legal traditions. This forms a solid basis for the acceptance of a decision support system in international contracting as foreseen in this work. A common notion of contract among contract parties from different legal traditions is essential. It is perceived as the minimum common ground that contract parties have to agree upon. Without a shared understanding of the concept of a contract, any decision support provided

at the time of contract conclusion about suited means of dispute resolution[2] (*i.e.*, jurisdiction and applicable law) would risk to become irrelevant.

## 2.3 Electronic Services

This work is concerned with issues of international contracting for (commercial) electronic services. Accordingly, an explanation is needed of what an electronic service is, meaning what characteristics it shows and how service types are differentiated in terms of a service classification.

To this aim, Sections 2.3.1 to 2.3.3 introduce service classification approaches as found in EU law[3], standardization documents issued by the International Telecommunications Union, and within the ISO/OSI reference model, respectively. Section 2.3.4 assesses these three classification approaches in a comparative manner, which is followed by a more fine-granular and contracting-oriented classification approach determined and described in Section 2.3.5. Section 2.3.6, finally, summarizes obtained insight into different notions of electronic service-related terminology and it documents the respective understanding adopted in this thesis.

### 2.3.1 Service Classification in EU Law

From a legal and, in particular, from a regulatory viewpoint, it is a standard approach to separate communications from content and information services. This means that there are typically different regulations to apply to those services that relate to the conveyance of data and to those services that relate to the provision of information and content. This principle to separate legislation on data transmission or (tele-)communications services, on the one hand, from legislation on value-added or content services, on the other hand, is reflected by all major related EU directives and regulations, *e.g.*, by the directive on electronic commerce [35]. In EU terminology, these service categories are called electronic communications services [36] and information society services [33, 34], respectively.

Information society services are defined as *"any service normally provided for remuneration, at a distance, by electronic means and at the individual request of a recipient of services*" [34]. Electronic communications services are defined as "*a service normally provided for remuneration which consists wholly or mainly in the conveyance of signals on electronic communications networks, including telecommunications services and transmission services in networks used for broadcasting, [...]*" [36]. Consequently, information society and communications services share a typical, but non-mandatory common attribute, that of service provisioning in compensation for money. Both service types are bound to electronic communication means. In contrast, attributes of distant communication and on-request provisioning

[2]Dispute resolution in contracts with international connection relates to procedural law. PIL determines procedural law. The application of PIL, in particular with respect to the question of applicable law, results in a pointer to material law — possibly including a state-specific understanding of an international service contract.

[3]The choice for an investigation from EU law perspective is two-fold. First, the EU law collection represents an embracing law collection that shows relatively many legal acts which cover a notion of services. Second, the European perspective matches directly the case-based modeling and implementation of the Brussels I Regulation as documented in Chapter 6 and Chapter 7, respectively.

are exclusive to information society services. It may be argued, however, that the case of distant communication is implied in communication services as well, since data conveyed might not cross a single personal area or local area network only. Hence, information society services are essentially characterized by on-demand individual request and by making use of electronic communication services, whereas electronic communication services are characterized by the fact that they are primarily concerned with data transmission. In other words, any service that uses electronic communications service, thus, leverages a pure data transmission service, and that offers some sort of additional functionality — *e.g.*, content or information — to a user based on that user's request may be termed information society service.

### 2.3.2 Service Classification According to ITU

There are further approaches to service classification to be considered. Prominent examples include service types defined by the International Telecommunication Union (ITU) and by the International Organization for Standardization (ISO). The ITU, which focuses by tradition on electronic communications services (in EU terminology), structures services into basic and supplementary services [52]. The use of two classes is directly comparable to the approach adopted by the EU's. Moreover, basic and supplementary services may be mapped to electronic communications services and information society services, respectively. Due to the ITU's more strict focus on telecommunications, however, examples given of supplementary services [53] are still closely related to core telecommunications functionality, whereas they determine still value-added services provided by the use of basic transmission-oriented services.

A basic service is defined as "*the fundamental type of service, or the most commonly provided service in a telecommunications network. It forms the basis upon which supplementary services may be added*" [52]. Supplementary services are defined as "*any service provided by a network in addition to its basic service or services*" [52]. Of note here is that a supplementary service is seen as a service offered by the network and not by, *e.g.*, a content provider. This viewpoint deviates from EU terminology of information society services, and this viewpoint clearly reflects a traditional telecommunications perspective.

Furthermore, the ITU definition given for a basic service implies that, *sensu stricto*, there is exactly one basic service in a telecommunications network, *i.e.*, the most commonly provided service. On the other hand, the definition of supplementary services refers to basic services — as in plural for multiple basic services. It may be concluded that the ITU basic service definition is semantically misleading in strict terms, so that the existence of multiple basic services per network is assumed subsequently.

In addition to basic and supplementary services, the ITU defines a service — the term service is used synonymously to that of a telecommunication service — as "*that which is offered by an Administration or RPOA [a recognized telecommunications operator] to its customers in order to satisfy a specific telecommunication requirement*" [52]. Bearer services, teleservices, and teleaction services constitute examples of ITU (telecommunications) services [52, 54], some of which may be subsumed as basic services (*e.g.*, bearer services), while others may involve supplementary services as well.

ITU's (telecommunication) service definition implies a service provisioning for remuneration by the use of customer (as opposed to a non-commercial term, such as user or service recipient). Since both, a basic and a supplementary service, determine services, the characteristic of provision for remuneration may be assumed for basic and supplementary services, respectively. This is, thus, in line with EU terminology of electronic communications and information society services.

As a further service category, the ITU defines demand services (or demand telecommunication services) which are perceived as "*a type of telecommunication service in which the communication path is established almost immediately, in response to a user request effected by means of user-network signalling*" [54]. In contrast to EU terminology, where on-demand provisioning is attributed to information society services only, the ITU, thus, relates the characteristic of user request to basic services as well.

### 2.3.3 Service Classification According to ISO

In contrast to ITU and EU service classification approaches, the third approach investigated here, that of the ISO and its sub-committee for Open Systems Interconnection (OSI), provides a direct definition for value-added services. This definition is based on the OSI reference model [112] which is reflected in partly adapted manner by the Department of Defense reference model laying down the main principles of the Internet [70]. The OSI reference model differentiates, again, two service types, namely a service and a value-added service.

This service classification is a direct consequence of the strictly layered approach the OSI reference model adopts. Any given entity of layer N may offer a set of well-defined functionality, accessed via a well-defined interface (a service access point) to a corresponding entity of the next-higher layer N+1. Such offered functionality from one lower layer to one layer above is perceived as a service. The OSI reference model features seven distinct layers so that "*except for the highest layer which operates for its own purposes [...] the (N) entities add value to the (N-1) service they get from the (N-1) layer and offer this value-added service, i.e., the (N) service to the (N+1) entities*" [112]. The ISO/OSI definition of value-added service, thus, is a recursive one covering the process of adding value throughout a layer hierarchy. This recursive understanding is not reflected by either the ITU or the EU as presented previously. Those service classifications may determine two main service types, which may be related to basic communications-oriented and value-added content services, even though value added is seen to accrue only once, namely at a (not fully defined) transition from a basic communications services to a (value-added) service that adds functionality beyond pure transmission.

A service notion inspired by the OSI reference model (or the Department of Defense reference model) integrating a single transition from basic to value-added service was adopted by some in recent years. [31] lists a number of publications from the legal domain in relation to German national law and a differentiation between basic and value-added services based on ISO/OSI and Department of Defense models. The service classification approach adopted by these publications is summarized as that "*functionalities and services respectively above OSI layer 4 are not classified as telecommunication service, but rather as 'information society service'*" [31].

While this classification may be appropriate in a traditional client/server context, [31] shows it to be clearly insufficient in the case of peer-to-peer (P2P) networks that form overlay networks. Overlays are typically implemented on OSI layer 7, the application layer, so that overlay services would qualify as information society services according to the classification presented. Since overlay networks often not only include content provisioning tasks, but resource location and data forwarding tasks as well, the ISO/OSI-based classification often cannot apply fully to P2P networks. Therefore, [31] concludes that "*the ISO/OSI model can be used as guidance for a legal classification, but not as exclusive measure*".

### 2.3.4 Valuation of Considered Classification Approaches

In order to summarize, and with regard to a service understanding applicable to this work, neither of these three classification approaches presented is found directly applicable. The OSI reference model approach was shown insufficient to cope with overlays and application layer P2P networks. Although this work is not specific to any network type in the Internet, this approach cannot find full application here.

The ITU approach differentiates basic from supplementary services. This structuring principle may serve as a basis for this work's focus. However, the ITU approach is clearly focused on traditional telecommunications services, such as voice telephony services. And even within the range of ITU's view on integrated networks, the respective supplementary service range envisaged appears too narrow. It remains unclear, whether ITU's definitions are supposed to support a wider service range adoption. Moreover, the ITU definition of basic services was found misleading to some extent. Hence, this approach cannot be adopted here.

As for the EU classification approach and terminology, the structuring principle of communications and information society services is deemed compatible in general. In order to assess whether those characteristic criteria in the EU approach — commercial, distant, electronic service provision potentially consisting mainly/wholly in conveyance of signals, potentially in on-demand manner — can find full application, however, the key set of envisioned services has to be identified and characterized in further detail. To this aim, Section 2.3.5 introduces a comprehensive service classification approach for value-added services.

### 2.3.5 Classification Approach for Value-added Services

With respect to what offerings services in the Internet might comprise and to an according structuring, a few approaches can be found in literature. [61] and [71] show exemplarily how such a grouping typically looks like. On-line services are grouped according to what users are offered by a given service. [61] determines these groups as to consist of content, features, e-commerce access, and interactive services. [71] groups into content, features, and services. For the purposes of this work, a similar-looking grouping is used. However, the structuring in use here goes beyond and incorporates those two key dimensions needed from a contracting point of view, resulting in a matrix as shown in Table 2.1.

The first dimension reflects the respective primary contractual object, in terms of a main obligation. It determines what a service provider's main obligation in a related service contract is or, in other words, what a service customer has to remunerate for (the respective

Table 2.1: Value-added Service Classification Based on Primary Contracted Obligation and Nature of Legal Transaction

| | Main contractual obligation | | |
|---|---|---|---|
| **Legal transaction** | **Functionality** | **Resource** | **Result** |
| **Property transfer** | Unlimited, exclusive use of non-customized service functionality[a] | Unlimited, exclusive use of non-customized resource[b] | Unlimited, exclusive use of non-customized result[c] |
| **Cession of right to use** | Time-wise limited, exclusive use of non-customized service functionality | Time-wise limited, exclusive use of non-customized resource | Time-wise limited, exclusive use of non-customized result |
| **Work[d]** | Customized functionality with guaranteed Quality-of-Service (QoS) and/or Quality-of-Experience (QoE) | Customized resource with guaranteed characteristics | Customized result with with guaranteed characteristics |
| **Mandate[e]** | Customized functionality without guaranteed service quality (best effort service) | Customized resource without guaranteed characteristics | Customized result without guaranteed characteristics |

[a] Implies the *de facto* sale of a considered service to a service customer. This is not envisaged by this work.
[b] Implies the *de facto* sale of a considered resource to a service customer. This is not envisaged by this work.
[c] Implies a contract of sale. This is not envisaged by this work.
[d] Continuing obligations – as typically seen in subscription-based services – are not foreseen by work-type contracts. This is acknowledged but abstracted from here.
[e] Continuing obligations – as typically seen in subscription-based services – are not foreseen by mandate-type contracts. This is acknowledged but abstracted from here.

counter-obligation assumed here). A provider's obligation in (value-added) service provisioning may consist in making available a service that allows a service user to employ a functionality, to utilize an IT resource, or to obtain a result. These obligations are understood concluding despite the fact this claim is hard to prove (if not impossible), but it may be substantiated by discussion.

The main argument for assuming completeness is in that these three aspects are sufficient to characterize any electronic service from a service provider's (IT service management) point of view: What a service reflects is a certain functionality, what it needs to run on are IT resources, and what it produces is a result of its functionality, *e.g.*, produced content. Moreover, a concluding list of obligations is assumed more likely due to the focus on obligations rather than on product offerings. The resulting groups may look similar at first. However, any given obligation is for itself more restricted in comprehension than a potentially complex product offering — it is supposed to focus a clearly allocatable duty. A contract may cover a complex product offering, involving (in this work's context) multiple services to be provided. Since a contract, by definition in civil law systems, is broken down into (main and secondary) obligations for the purpose of contract qualification, it is seen reasonable a choice to group after "atomic" contractual obligations, each represented by an assigned service (potentially including sub-services), rather than after a service composite which a typical complex product offering represents.

Functionality, resource, and result are by default inter-related as described. The respective obligations (*cf.* Table 2.1) are to be understood accordingly. For instance, if the focused obligation of a considered contract is qualified as functionality, this means that the main focus of such an obligation is found in letting a service user employ a service's functionality. Of course, that service requires IT resources to be in place, and it might produce a result, but these aspects of resource usage and delivered result are seen subordinate to that service's

main obligation, putting an emphasis on functionality in this example. To emphasize, it is a service's functionality that is contracted, while result and resource are side-aspects in that contract. Accordingly, the provisioning of functionality constitutes the main obligation of a service provider. Obligations of resource usage and functionality result may constitute contractual obligations as well, whereas these are assessed subordinate to functionality provisioning for a considered service.

Similarly, in case of a service qualified as resource in Table 2.1, that service disposes of a certain functionality for sure, and it might produce results, whereas in such an example the main obligation is found in providing access to a resource via that service. In general, thus, this dimension of Table 2.1 is perceived as the main focus of a given service obligation, not as an exclusive focus. Accordingly, resource access by means of a considered service constitutes the main obligation of a service provider. Obligations of functionality provisioning and functionality result may constitute contractual obligations as well, whereas these are assessed subordinate to resource access.

In the same line of thought, thus, the delivery of functionality result by means of a considered service constitutes the main obligation of a service provider, in case of a service qualified as result in Table 2.1. Obligations of functionality provisioning and resource usage may constitute contractual obligations as well, whereas these are assessed subordinate to result delivery.

The second dimension in Table 2.1 reflects the nature of legal transaction to be attributed. These four legal transaction types considered comprehend property transfer, cession of the right to use, work, and mandate. These legal transaction types are chosen since they directly represent the applicable grouping criteria for nominate (standard, basic) contract types in a civil law system, such as covered by the Swiss Code of Obligations [18]. This choice is reasoned by the fact that there is no nominate contract available today for a service contract. Consequently, a service contract may be either qualified to feature characteristics of one of these mentioned legal transactions, or it may be termed a contract of its own type. The first would lead to analog application of, and subsumption under existing law governing existing nominate contracts, while the latter would lead to qualification as innominate contract *sui generis*.

A full qualification of a service contract is a challenging and a time consuming undertaking for reasons of complexity and scope. It needs to be noted that questions of analog application regularly lead to fundamental discussion in the legal domain. To pick only one example, [40] discusses issues of analog application of certain mandate contract law rules to continuing obligations of a franchising contract in Switzerland. As [40] finds that there are about as many Swiss supreme court decisions to be taken as arguments in favor of analog application as there are decisions that would forbid analog application, there seems to be no clear answer to this question as of today.

Accordingly, the second dimension in Table 2.1 must not be understood as an argument for analog application of any existing nominate contract type law. In contrast, it is important to see that this dimension shall reflect the primary nature of a legal transaction for a considered service only. For the question of analog application or subsumption, a thorough detailed investigation including available court decisions and comments would be required. In that sense, if a service is qualified as mandate for example, this implies that the accordingly related legal transition happening in the considered service shows the main characteristics of

a mandate, *i.e.*, that a service provider is undertaking activities assigned under that mandate diligently, whereas success guarantees cannot be provided. Similarly, a qualification as work means that it is within a service provider's duty to produce a result — a work — according to what was agreed in the respective contract, this time including guarantees for success. With a qualification as cession of the right to use, primary focus, in contrast, is neither on diligent execution of activities, nor on production of a work with guarantees, it is on a time-wise limited, exclusive usage right of a good (in economic terms). Finally, the legal transaction of a property transfer involves that ownership of a service-related good (again, in economic terms) is handed over from a service provider to a service customer.

A few examples shall depict how existing value-added services may be mapped to the service classification as introduced in Table 2.1. A service which is mainly concerned with the exchange of content (*e.g.*, video conferencing or electronic data interchange between companies) is probably most suited to be subsumed under functionality. The same holds true for examples of services that are mainly concerned with publication of content (*e.g.*, on-line advertising). For these example services, exchange and publication, respectively, determine primary obligation focus. Content is involved, but it is not a result of the considered service, content is only exchanged. Further examples potentially qualifying as functionality may be web services and Software-as-a-Service (SaaS). For the dimension of legal transaction applicable to these examples, cession of right to use may be assumed for SaaS and for web service aggregation. Work or mandate qualify probably better for content exchange and content publication examples, depending on whether any service quality is agreed upon or not.

Hosting or virtualization may be areas for value-added service provisioning to be subsumed under resource. Typically, and under the assumption that resource customization is not a major focus in the accordingly concluded contract, these example services would qualify as cession of right to use with respect to legal transaction nature. Examples where the main contractual obligation is found in a result comprise typical content services like subscription-based services to acquire music by download, to receive news updates, IPTV, or to retrieve geo-location — to name a few. If for these services the main obligation is fulfilled once the result is made available, then these services are qualified to feature work characteristics. If no guarantees with respect to a service's contracted result is granted, mandate is seen the best fitting legal transaction type — except for the case where exclusive use of a non-customized result, such as non-individualized, non-guaranteed content delivery, is agreed. In this case, cession of right to use or property transfer may be a better fit.

### 2.3.6 Service Classification Summary and Adopted Notion

At this point of discussion, a classification scheme for value-added services has been introduced and those value-added service definitions of the ITU and according to the ISO/OSI reference model have been decided to not apply to this work. Consequently, an answer needs to be found whether EU terminology for information society services and electronic communications services, respectively, may be compatible with the introduced value-added service classification.

First, a differentiation into two service classes is seen meaningful, in particular for the purpose to express value added atop of what a more basic service delivers. Second, for ter-

minology, terms of information society and electronic communications services are semantically adopted, but replaced by terms of value-added services and basic services, respectively. This is for the reason that a value-added service is perceived as the direct counter-part service of a non-value-added service, thus, of a basic service. Third, those characteristic criteria for information society services — normally provided for remuneration, at a distance, by electronic means and at the individual request of a recipient of services — fit in parts.

Monetary compensation is assumed, so is provisioning by electronic means. Distant provisioning is not given by the value-added service classification introduced, but implied by this work's focus on PIL aspects of jurisdiction and applicable law in international service contracts. Hence, distant provisioning is assumed given, while it is not required for the understanding of value-added service, *sensu stricto*.

On-request provisioning, finally, is assessed only partly relevant. If perceived in the sense that a service customer has expressed its will to receive a service by agreeing to the respective contract, then this notion of on-request provisioning is accepted. If it is perceived, however, in the sense that only pull-type (as opposed to push-type) service provisioning is envisaged, then this cannot be accepted. For the case of basic services, those characteristic criteria outlined are deemed fully applicable. In addition, distant and on-request service provisioning are assumed under the exact same terms as in the case for value-added services.

In summary, this work bases on the derived understanding of value-added and basic services. This understanding is close to EU terminology of information society and electronic communication services. Moreover, this work focuses primarily on value-added services, for which the introduced classification according to main contractual obligation and legal transaction nature applies.

## 2.4 Electronic Contracts

Electronic contracting and the representation of contracts in electronic form has attracted a wide variety of research. Research efforts range from terminology definitions and electronic contracting classifications to comprehensive electronic contracting frameworks, standardization efforts in representing electronic contracts, and to diverse discussions of specific issues relevant to electronic contracting. The latter includes, to name only a prominent example, questions of automated negotiations by means of software agents [108, 109, 30, 82, 5, 38, 73]. Such aspects are not investigated in detail here. Instead, this section aims to develop the accordingly applicable understanding of electronic contracting (Section 2.4.1), to classify this work (Section 2.4.2), to determine whether there is a *de facto* or *de jure* standard for electronic contract representation (Section 2.4.3), and to introduce PIL issues in electronic contracting (Section 2.4.4).

### 2.4.1 Electronic Contracting (E-contracting)

Electronic contracts and the respective activity of electronic contracting (often abbreviated as e-contracting) constitute aspects of key importance to this work. An electronic contract is commonly understood as a contract in electronic representation. [11] determines electronic contracting as to aim "*at the automation of contract establishment and enactment*". While there are many other definitions of e-contracting, this one is the only one found in relation to

automation. Based on the set of five identified areas of risk and value in relation to information technology usage in companies — financial values, strategic values, stakeholder values, competitive strategy risk, and organizational risk — [11] develops these value and risk contributors for the context of electronic contracting by introducing further detail in the area of values and by reducing granularity in the area of risks. This is reasoned by the specific focus definition adopted in [11] ("*discussion of risk values of e-contracting is not part of our goals in the paper*") rather than by attributing risks a lower impact in electronic contracting in general. Accordingly, [11] acknowledges risk management in electronic contracting as follows: "*It must be noted that in addition to the possible risks introduced by e-contracting, this new technology can allow currently existing risks to be decreased. E-contracting can reduce the existing risks between contracting parties by improving the contract quality, reducing costs and time, improving parties' flexibility, or through the new opportunities which it provides.*" For the purposes of this work, risk assessment is seen as the key motivation for automation in contract formation. Consequently, aspects of risk and transaction costs in electronic contracting need to be discussed comprehensively (*cf.* Section 2.5).

In order to outline the electronic contracting focus applicable to this work a suitable classification scheme is needed. The classification scheme for automated negotiation systems introduced in [13] differentiates negotiation support systems, intelligent agents, auction mechanisms, and on-line market spaces. When applying this scheme, this work is found to share partly characteristics of multiple categories, having most in common with what is defined as a negotiation support system. Accordingly this work cannot be attributed clearly to a single category so that this schema is discarded. More recent approaches which are less agent- and technology-driven, include the classification scheme introduced in [10] and the 4W framework for B2B electronic contracts [8, 9]. Both approaches originate from the same authors, while each approach follow different purposes. [10] focuses primarily on different e-contracting paradigms (*e.g.*, micro contracting) within electronic business transactions. These paradigms are not discussed in detail here, whereas the 4W framework is presented and applied subsequently.

### 2.4.2 Classification According to the 4W Framework

The 4W framework states that the concept of a contract, in general, should refer to involved actors (*w*ho), the respective contracting context (*w*here), the contracted object (*w*hat), and to the applicable contracting processes (ho*w*). These four basic contracting dimensions are then further structured and inter-linked so that a detailed formal modeling of an electronic B2B contract results. The 4W framework, thus, provides a comprehensive source for content-wise and procedural analysis in e-contracting. It, however, (mostly) abstracts from legal issues. Despite the fact that legal issues are mentioned and that choice of law is referenced, the 4W framework does not refer to, nor does it reflect in its framework the material or procedural foundation of contract law or PIL. The framework simply foresees that a contract — which, for instance, is not further differentiated in national or international contract — has a context, whereas context may mean legal context. It does not explain how to obtain and model such a legal context in detail.

Hence, the 4W framework is of use to this work insofar as that dimensions of who, what, where, and how can categorize this work's e-contracting focus, while the 4W framework is

not relevant to this work in any legal aspect of international contracting (for a detailed discussion of PIL aspects of relevance see Section 2.7). Regarding involved actors and their business relation, thus, with respect to the dimension of who and where, bilateral (one-to-one) contracting is envisioned in this work. This means that a contractual relationship between a (single) service provider and a (single) service customer is considered. This work abstracts from any potential contractual relationship between a service provider and its suppliers, as well as it abstracts from potential contractual relationships between a service customer and related service user(s). It is important to note that the 4W framework is limited to B2B whereas this work considers both, professional and private service customers. The latter case refers to an international consumer contract. It is to be clearly differentiated from an international contract with a professional customer, since both contract types see different rights and legal requirements, such as they differ in regard to contractual freedom which is relevant to the question of choice of jurisdiction and choice of law.

As for the dimension of what, the exchanged value between service provider and service customer of relevance here is a service (as opposed to the other two applicable types of the 4W framework, product and financial reward). These value types of the 4W framework do not reflect established categorization schemes used in contract law. Table 2.2 presents the structuring of nominate, *i.e.*, standard and well-determined contract types[4] as of the Swiss Code of Obligations [18]. This categorization is driven by the dimension of what, too, only does it primarily differentiate whether (a) a (material) good is transferred, (b) a provider needs to deliver an actually working result, or (c) a provider is obliged to take action without owing a working result to its contractual counterpart. As can be seen from Table 2.2, there is no nominate contract for (electronic) services. This is due to the fact that service contracts are typically complex in their nature as they often include aspects of multiple nominate contracts. Despite imminent complexity, it is not only important but required to know how a foreseen (service) contract is to be characterized from a legal perspective. This will reveal any required basic contract term as well as non-mandatory but recommended contract terms, the *essentialia* and *accidentalia negotii*, respectively. Without knowledge about at least the *essentialia negotii*, the dimension of what remains unclear — a fact that renders any effort put in establishing a related electronic contract prone to risk of uncertainty or even void. Section 2.3 provides more detailed background information on characteristics and impact of electronic services as considered in this work.

The dimension of how is of central importance to classify this work — even though it is, similarly to these other dimensions of the 4W framework, not driven by primarily contract law criteria but rather by a business perspective. The dimension of how covers the question of representation and standards in use as discussed subsequently.

### 2.4.3 Electronic Contract Representation

In the context of this work, a machine-readable representation of key contractual parameters is envisaged, since machine-executable automation is targeted. More precisely, machine-readable contract representation is an objective in the longer term, whereas the focus of this

[4]See Annex A for the respective matching original terminology in German and French. The respective list of nominate contracts may differ from jurisdiction to jurisdiction, and it might be that such list is inexistent in some jurisdictions. The list of nominate contracts as determined by the Swiss Code of Obligations is seen as a reference case for nominate contract types from a (continental) European angle.

Table 2.2: Swiss Code of Obligations Nominate Contract Types

| Contract type | Legal transaction | Articles in code |
|---|---|---|
| **Sale, change** | Ownership transfer of a sales good in exchange for a purchase price (sale) or in exchange of another transfer (change). | 184-238 |
| **Gift** | Donation among living persons without counter-performance. | 239-252 |
| **Rent, leasehold** | Good transfer for use in exchange for a rent (rent). Good or rights transfer for commercially exploitable use (leasehold). | 253-304 |
| **Borrowing, loan** | Good transfer for use (including obligation to return after use) free of charge (borrowing) or in exchange for a good of the same kind as the lent good, typically interest (loan). | 305-318 |
| **Employment** | Labor performance on duty of employer in exchange for a wage. | 319-362 |
| **Work and labor** | Production of a work in exchange for compensation. | 363-379 |
| **Publishing** | Work transfer for publication, reproduction, and distribution. | 380-393 |
| **Order** | Procurement of delegated business or services in exchange for compensation if compensation agreed or common. | 394-418 |
| **Agency of necessity** | Business management conforming to the presumable will and benefit of the principal. | 419-424 |
| **Commission** | Purchase and sale of goods or securities on one's own behalf but on account of the other contract party in exchange for commission. | 425-439 |
| **Affreightment** | Transport of goods in exchange for compensation. | 440-457 |
| **Procuration, Power of attorney** | Entitlement to operate business for the owner and to sign per procura for the business. | 458-465 |
| **Allocation** | Entitlement of the assignee to provide money or securities on account of the assignor to the assignment receiver; entitlement of the assignment receiver to claim performance from assignee in the assignment receiver's own name. | 466-471 |
| **Deposit** | Depositor obliges keeper to take over and securely store a movable good in exchange for compensation if compensation explicitly mentioned or to be expected. | 472-491 |
| **Surety/bail** | A bailsman's obligation to vouch for the principal debt of a debtor for the benefit of the creditor. | 492-512 |
| **Play and bet** | Promise of an obligation on contrary conditions which lead to a winner and a loser. | 513-515 |
| **Annuity, prebend** | Payment of an annuity for life of the debtor, creditor, or of a third person. | 516-529 |
| **Non-trading Partnership** | Contractual relationship of 2 or more persons for the purpose of achieving a common purpose using common resources. | 530-551 |

work is given by determining jurisdiction and applicable law recommendations for an international contract in automated form. In this light, a decision about technical standards to represent a contract electronically has not been reached. The 4W framework addresses business and technical standards in order to achieve interoperability between contract parties. Furthermore, the dimension of how covers contractual phases, which comprise informational, pre-contractual, creation, and enactment phases [8, 9]. This work is motivated by an integral viewpoint on the complete contractual life cycle, while an automated contract formation clearly falls under the respective 4W framework phase of creation. Section 2.5.3 addresses contract phases in full detail.

Despite not being in the focus here, the key set of common characteristics among methods and standards for electronic contract representation is determined as follows. First, even

though there are many competing approaches for electronic contract representation (see [7] for a dated while still comprehensive overview of standardization bodies and approaches), neither sees as wide an adoption as *de jure* nor *de facto* standard in e-contracting. Secondly, all approaches base the actual contract representation on XML (*e.g.*, CEL [104]) for structuring, traversal, and representation flexibility reasons. Thirdly, dual representation — *i.e.*, representation in human- and machine-readable form — is perceived of key importance. Fourthly, electronic contracts are, content-wise, depending on a mechanism to express and handle rules, while conflicts between rules shall be avoided, *e.g.*, by means of rule prioritization. Accordingly, many approaches rely on principles of defeasible and deontic logic [44, 45, 42].

### 2.4.4 PIL Issues in E-contracting

In addition to those presented classification, technical representation, and standardization research challenges, research in the field of electronic contracts has been raising a plethora of legal questions. Such questions are typically concerned with how an electronic contract relates to traditional paper-based or orally concluded contracts. Accordingly, formal and technical requirements and issues of recognition are discussed.

[66] is representative for many articles published at the time when the Internet became widely used. Even though [66] acknowledges that electronic contracts raise a number of challenging problems "*not usually associated with oral or written contracts*", he concludes that these problems are not irreconcilable. In order to address these problems, [66] proposes a three-question procedure, which — once these three questions have been answered — ensures an electronic contract is manageable in a way a traditional paper-based or oral contract is manageable. These three questions are: "*When was the contract concluded? What are the terms of the contract? Where is the contract governed?*" The last question is of direct relevance to this work, since it is concerned with issues of PIL, namely with jurisdiction and (indirectly) applicable law in an international contract. Although the positivistic conclusion of [66] may appear clearly validated today (*e.g.*, refer to [35] for form requirements in e-commerce, such as electronic signatures), especially that last question of PIL issues in international contracts is still far from a state free of challenges — despite international harmonization efforts (see Section 2.6), and in particular with respect to international contracts for electronic services in the Internet (see Section 2.7).

## 2.5 Contract Formation and Transaction Costs

As introduced previously this work is concerned primarily with the contract formation phase, while this work's main motivation is determined by a viewpoint on the complete service and contract life cycle. This motivation was, so far, presented from a more intuitive, explanatory angle insofar as that risks of a potential contract qualification in court need to be considered at the time of contract formation already. This argument is fully in-line with the widely adopted transaction cost theory [23, 110]. The concept of transaction costs is related to three areas, namely to those of economics in general, to organization theory for organization-internal concerns, and to contract law "*in which contract is addressed as a governance issue*" [110]. Accordingly, Section 2.5.1 describes transaction costs accruing along a contract life cycle.

This is complemented by outlining the set of impact factors to determine transaction costs in relation to electronic services in Section 2.5.2, while Section 2.5.3 details on the different states an agreement goes through until it reflects a contract.

### 2.5.1 Transaction Costs in Contracting

Transaction costs are incurred in transactions between market participants. [110] defines a transaction to occur "*when a good or service is transferred across a technologically separable interface*". This definition, being expressed in technical terms, is directly applicable to the purposes of this work. Accordingly, this work sees the subject matter of a to be formed international service contract to wrap the characteristics of a business transaction related to the provision of an electronic service in the Internet. Any exchange between involved parties — for instance, with respect to contract formation or within the actual service provisioning — takes place remotely and by the use communications technology offered by IP-based networks. Thus, in accordance with the transaction definition of [110], this work addresses transactions since it addresses services to be transferred by means of technologically identified and separate interfaces between contract parties.

During a transaction, a variety of different costs — transaction costs — need to be considered [24]: "*In order to carry out a market transaction it is necessary to discover who it is that one wishes to deal with, to inform people that one wishes to deal and on what terms, to conduct negotiations leading up to a bargain, to draw up the contract, to undertake the inspection needed to make sure that the terms of the contract are being observed and so on. These operations are often extremely costly, sufficiently costly at any rate to prevent many transactions that would be carried out in a world in which the pricing system worked without cost.*" Consequently, transaction costs can be classified into cost categories of "*search and information costs, bargaining and decision costs, policing and enforcement costs*" [29]. When mapping these transaction cost categories to a contract life cycle, the first two categories are determined as *ex ante*, whereas the third category is determined as *ex post* costs. In the context of this work, the automated determination of jurisdiction and applicable law recommendations during contract formation phase represents *ex ante* costs. The effort to support automation may even raise *ex ante* transaction costs in the first place. It needs to be noted, however, that manual contract formation is not free from costs either.

[29] further argues that these three presented cost categories could be subsumed under a single transaction cost category as all categories result from "*resource losses incurred due to imperfect information*". Irrespective of whether to differentiate according to contracting time phases or according to the reason for transaction costs, [110] determined the relevant set of three dimensions to impact transaction costs as follows: "*(1) uncertainty, (2) the frequency with which transactions recur, and (3) the degree to which durable, transaction-specific investments are required to realize least cost supply.*" Consequently, these dimensions need to be assessed in order to estimate transaction costs to be expected in the context of this work, meaning in automated contract formation — or at least jurisdiction and applicable law recommendations for the time being — for electronic services in the Internet.

### 2.5.2 Determinants of Transaction Costs

*Ex ante*, that is before actually analyzing any relevant PIL, transaction specificity is to be expected considerably high: Even without detailed knowledge of required input parameters — the so-called connecting factors — the procedure to determine jurisdiction and applicable law in an international contract is complex and, more importantly here, highly specific to the respectively applicable contract and contract party characteristics. As with respect to transaction frequency, there cannot be a general assessment, since transaction frequency is depending on the contracted service. In case a service targeting masses of consumers in the Internet is envisaged transaction frequency is high. In case of a longer lasting business collaboration between professional service providers and customers, however, transaction frequency might be comparably low. Within the scope of this work, service specifics are not touched so that a conclusive assessment with respect to transaction frequency is not possible.

When it comes to the first impact dimension, uncertainty, then a clear assessment of high transaction costs is to be made. [110] substantiates this as he finds that "*it is widely recognized — by economists, lawyers, and others who have an interest in contracting — that complex contracts are costly to write and enforce. There is a tendency, however, to accept this fact as given rather than inquire into the reasons for it.*" [110], thus, adopts an integrative perspective on the complete contract life cycle in determining transaction costs, in the same way as this work has been introduced and motivated (*cf.* Section 1.1). This perspective includes not only a contract's formation phase, but also potential costs related to contract enforcement. In other words, uncertainty is an important factor to be aware of in contracting. In addition, uncertainty is expected to be increased in international contracting with contracts being formed between distant parties and for immaterial goods delivered by means of the Internet. Since these reasons of contracting uncertainty may result in transaction costs, a risk assessment considering the complete contract life cycle is needed when designing support for automation during contract formation.

[110] states that both, *ex ante* and *ex post* transaction costs are often accepted given. This work, in contrast, adopts the contrary position by following the key efficiency argument in the transaction cost theory. Accordingly, this work states its motivation hypothesis as that total economic efficiency is maximized when total transaction costs are minimized, that is the sum of *ex ante* and *ex post* transaction costs — whereas this work realizes that there is a trade-off between *ex ante* and *ex post* transaction costs. As argued previously, *ex ante* transaction costs may be increased by introducing a risk assessment that covers the impact of potential *ex post* costs. On the other hand, if such a risk assessment and the accordingly designed contract formation procedures help avoid or at least lower *ex post* costs, then the total transaction costs are expected to be lower, resulting in a more efficient, less uncertain situation for service provider and customer.

### 2.5.3 Invitation to Negotiation, Offer, and Contract

While the analysis conducted in Sections 2.5.1 and 2.5.2 underlines that the DeRISC decision support system developed in this thesis shall provide a means to decrease *ex post* costs, a number of imminent and more fundamental questions in relation to contract formation remains to be addressed here. These questions are concerned with the when, what, and where [66] an electronic contract (*cf.* Section 2.4.4) came into existence in the first place.

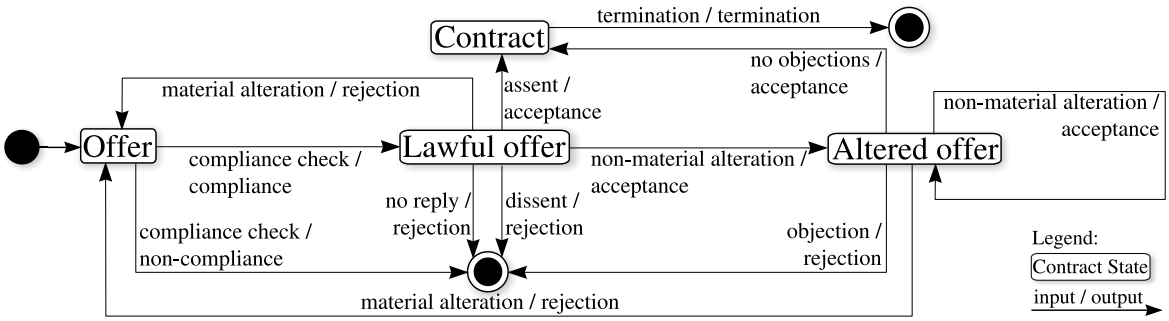


Figure 2.4: CISG-compliant Contract Formation Finite State Machine [102]

These questions see no obvious answer in the sense that legal requirements on, for instance, the dimension of when a contract can actually be called a contract may differ from legal system to legal system. As with respect to those various is- sues arising with contracts to be formed in the Internet — [66] and [4] provide insight into some related key challenges like form requirements in writing, expression of consent, or legal capacity of a machine/an agent representing a natural or legal person — the following assumptions are adopted within this work: First, even though these challenges shall be explicitly noted, and their fundamental impact on contracts in the Internet is fully acknowledged, these issues are not discussed in detail here. This decision is taken for purely practical reasons in order not to further widen this work's focus. Second, these challenges are considered to constitute ongoing research efforts in legal and technical domains. While related debates have led to the adoption of the respectively developed legal framework for electronic business in the Internet, such as the EU's e-commerce directive [35], many aspects remain subject to further investigation still.

Many of these challenges might exist due to the fact that traditional legal concepts such as territoriality and materiality of goods and persons are not easily transferred into the context of the Internet. For instance, for the question of applicable law, it may be important to know where an offered good or service was advertised, where relating to a geographical realm. A service advertisement in the Internet, however, is highly difficult to be said to be advertised in a specific geographical area [66]. There are plenty examples — some of which to be discussed in this work — where a direct attempt for re-use of established legal concepts in the Internet fails. On the other hand, the very procedure of contract formation is adopted unmodified as, *e.g.*, the United Nations Convention on Contracts for the International Sale of Goods (CISG, [88]) defines. The CISG is not applicable to the type of (purely) electronic services addressed here — its application is limited to international sales contracts of (material) goods. Nevertheless, the CISG determines a prominent example to outline the contract formation process in detail, a process that, in essence, is the same for electronic services in the Internet.

Figure 2.4 shows a contract formation finite state machine [102] which is compliant with the CISG. The state machine differentiates offers from contracts. The existence of a contract implies the previous existence of an accordingly determined offer. As an aspect not covered in Figure 2.4, it has to be noted that in the same way a contract bases on an offer, an offer typically bases on an invitation to negotiation (*invitatio ad offerendum*). The main difference between an invitation to negotiation and an offer is that an offer is formulated in a way that the offered party is able to accept (or deny) an offer by a simple accept (or not accept)

message. This is why, product descriptions in a web shop — even if descriptions include a price for a product or service — constitute invitations to negotiation rather than offers. If a customer adds a product to a (virtual) shopping basket, the invitation to negotiation issued by the web shop owner is accepted. Typically, there is no possibility for negotiations in a web shop, meaning that a customer only has two choices once a product is in the shopping cart: to buy the product for those conditions indicated, or to leave it. Nevertheless, at that point of an on-line web shop transaction at which a customer is able to express "*unconditional acceptance*" [66], an offer is present.

The CISG contract formation procedure modeled in Figure 2.4 starts with an offer. In case of a bilateral contract envisaged, an offer involves two contractual roles, that of the offerer, the issuer of an offer, and that of the offeree, the party that receives an offer. Upon an offer received, an offeree may either accept or reject the offer. Explicit acceptance renders the offer into a contract, thus, into a binding agreement on which both contract parties have reached consensus willingly and knowingly. Further acceptance by the offerer is not needed anymore, as the offerer's acceptance is implicit to issuing an offer. The case of offer denial includes three sub-cases. In case the offeree generally agrees with the offer, but alters it in minor aspects, that altered offer is only rendered into a contract if the original offerer does not express any objections. Multiple rounds of non-material changes are possible, while the respectively altered offer is only turned into a contract, if the respective other party does not object.

Options for offer rejection include material offer changes, silence upon offer, and explicit offer rejection. The last option is the most simple one, where the offeree explicitly denies the offer received. The offeree can, alternatively, issue a counter-offer which will void and replace the initial offer. In addition, roles of offeree and offerer will change with a counter-offer. A counter-offer implies explicit offer rejection and, at the same time, a new offer that is materially different from the original offer. The third option for rejection is to stay silent on an offer. No reaction implies offer rejection. For that reason, offers are valid for a given time frame only. If the offeree did not respond within an offer's validity period, the offer is voided.

These procedures of the CISG reflect the state-of-the-art in international trade. Accordingly, the same principles are adopted in this work as the underlying, general contract formation procedures, even though the CISG is not directly applicable to contracts other than contracts of sale. This implies that, while being conducted in relation to a future contract, the automated determination of jurisdiction and applicable law recommendations is formally and conceptually related to an offer (in some cases even to an invitation to negotiation).

## 2.6 PIL and Electronic Business in the Internet

When business transactions have connection to different legal domains — to different jurisdictions — there is a chance that different legal traditions and their laws are touched. In some cases, an integration of different jurisdictions may be successful, in others it may lead to conflicts. Such conflicts originate essentially from state sovereignty and territoriality principles that prevail in law. These issues of conflicting laws apply equally to contracts related to electronic services in the Internet as well as to all other contracts with international connections. In the Internet, however, the problem is more pronounced, due to a fundamental

design gap identified between the legal domain and the Internet [102]. Territoriality is, *per se*, not reflected in the global infrastructure of the Internet.

Consequently, PIL-oriented questions and challenges have led to a wide range of research from the time on the Internet became popular. Section 2.6.1 addresses one of the most prominent discussions held in this area, namely whether there is need for a separate jurisdiction in the Internet, while Section 2.6.2 complements this by an outline of PIL-driven risk involved for electronic business in the Internet.

### 2.6.1 Internet Jurisdiction

At the time the Internet became widely used as a media means for the masses, a couple of general, fundamental questions from the legal domain in relation to jurisdiction in the Internet were raised. In [68], which is exemplary for a number of similar viewpoints and expectations expressed at that time, the question was discussed whether the Internet should have a separate legal jurisdiction. The main criterion to answer this question was based on whether or not there is a "*natural*" jurisdiction in or of the Internet. And if yes, what would be the legal consequences.

One possible way to address this question funds in the nature of the Internet as a global information infrastructure [74]. This understanding allows for comparison with those separate international conventions governing sea and admiralty law. However, [68] concludes, based on the idea that stakeholders in the Internet are forming a community (cybercommunity, networked community), that there is no need for a separate cyberlaw and a separate jurisdiction in the Internet. The authors suggest that involved groups such as the Internet Engineering Task Force would lay down (community) rules which are used as "*guidance for courts and governments*". Such analysis does not appear — seen from today — conclusive as it clearly did not happen in such a way that problems of conflicts are in-existent or diminishing by means of such community guidelines, neither has become the determination of jurisdiction clearer.

In a comprehensive overview of different emerging jurisdictional issues [111] concludes that the principle of territoriality will prevail as states consider it a core principle of sovereignty, while [74] anticipates the territoriality principle and with that national borders lose in importance in the Internet. [111] further observes a number of harmonization efforts and further concludes that even though *"states will face seemingly insurmountable problems in their efforts to domesticate a network of computers, they will gradually find solutions*". Both, the ongoing effort to harmonize jurisdiction in international contracts as well as the still prevailing territoriality principle, can be judged true from today. However, it must be noted that from these many international harmonization efforts no convention or similar act has resulted which is specific to jurisdiction in the Internet. Possibly this is due to the fact that community influence on a legal level is highly limited, contrary to what [68] was suggesting to happen.

In more recent articles, more focused approaches to PIL issues in the Internet are observed. For instance, [16] addresses the question of jurisdiction in relation to committed civil wrongs. This application scope might not fit the applicable scope of this work, whereas the article's results and its conclusion are of interest as [16] presents a simple rule-set (methodology) to determine jurisdiction — similar to what this work is aiming at — and [16] concludes

that *"private international law is sufficiently developed to overcome the challenges posed by the internet*". This conclusion, quite fundamental in nature, needs to be assessed by this work with regard to this work's distinctive scope, but even without such a final assessment ready, this work can be said to adopt a similar basic approach in that it takes the provisions of PIL as given and it attempts to develop a methodology for jurisdiction and applicable law determination based on it, whereas potential changes and issues are reserved.

In another more recent article, a conclusion of particular interest to this work is made, that of how the risk of multiple jurisdictions of relevance may influence counter-measures taken by service providers in the Internet [75], namely that it "*is likely to stimulate creativity and new Internet services such as more accurate and selective filtering technologies, stronger security zones and more robust, customized compliance capabilities*". Such tendency can be observed today in service provisioning where market separation is key, such as in commercial provisioning of copyrighted content. For example, a service provider might be entitled to stream episodes of a TV series to customers domiciled in its home market only. Filtering based on IP address ranges is an often used method. However, this method is, in principle, prone to errors and involves manual overhead, while those very same input parameters (connecting factors) needed to determine jurisdiction/applicable law may be used for the purpose to filter legitimate customers.

### 2.6.2 Risk for Electronic Business by PIL

In addition to these questions of separate Internet jurisdiction, territoriality, and international harmonization efforts as discussed, [1] represents a prominent example of those many articles addressing issues of jurisdictional risk, forum shopping, and the threat of long-arm jurisdiction to businesses doing transactions in the Internet. [1] admits that the risk to fall under jurisdiction of an unattractive court is inherent to Internet businesses. In order to limit the risks of long-arm jurisdiction [1] gives a number of specific advises to Internet businesses. These comprise to limit the interaction possibilities where possible, since interaction of some sort may lead to jurisdiction under certain circumstances already. This is in-line with the advise to undertake limitations with respect to unwanted customer segments — such as to limit locales on a web site. This might, in general, be reasonable thinking, it however seems applicable and reasonable only if a limitation in customer relations is wishful *per se*. This may often be an unrealistic assumption, especially in case a service in the Internet shall be offered to an international audience.

Further advises of [1] include to choose an ISP which operates within the same state as the business itself. Similarly, it is doubtful whether this may reflect operational and business characteristics of Internet businesses of today — at least to those targeting international customers. Finally, [1] suggests to have jurisdiction and applicable law clauses included in a contract. This, again, seems reasonable a measure in terms of general advise. And it is the standard case today. However, there are cases where choice of jurisdiction and choice of law is not allowed. Furthermore, the static clause of jurisdiction and/or applicable law might not withstand a court's inspection (thus it might be invalid) as its determination is complex and shows dependencies on the service to be contracted and on the respective contract party's connecting factors.

Overall, it can be concluded that the advises in [1] are generic and in general showing ways to limit risks, but in case an Internet business is targeting international markets with its services, these advises seem mostly obsolete. Thus, such a business has to meet the risk of jurisdictional issues anyway so that it is well advised to determine jurisdiction/applicable law in the right way (considering service and contract party specifics).

[41] acknowledges these mentioned risks for service providers in the Internet in relation to PIL, while [41] proposes a three factor targeting test which focuses on the criterion of foreseeability. The three factors of the targeting test comprise contracts, technology, and actual or implied knowledge. The first involves, for instance, choice of jurisdiction clauses in a contract, the second, *e.g.*, geo-location technology, and the third subsumes that knowledge which can be derived with respect to targeted jurisdiction such as that it "*assesses the knowledge the parties had or ought to have had about the geographic location of the online activity*".

[105] outlines in a comprehensive recent comparison between US and EU (European Union) PIL that "*in comparison to the EU special jurisdiction approach, the US specific jurisdiction approach is different. Whilst the US employs 'Zippo', 'effects' and 'targeting' tests, the EU adopted classical general and special jurisdiction approaches concerning special jurisdiction in the Brussels Regulation, in an effort to bolster confidence in E-commerce.*" Even though factors of the targeting test proposed in [41] are not implemented in European PIL, they still find partially expression in the European procedures to determine jurisdiction (and applicable law). The examples of PIL analyzed, modeled, and implemented in this work show contractual clauses considered, aspects with direct implication to technology (even if these aspects are not technology-driven) as well as considerations that incorporate contract party knowledge about intended/targeted jurisdictions.

Driven by a comparable argument that predictability is needed for businesses in the Internet, [83] withdraws initial approaches to address PIL aspects in the early days of the Internet, such as the Zippo approach. In contrast, [83] proposes to stay with the traditional approach to PIL, despite its acknowledged challenges faced in and by the Internet. Thus, better predictability is argued to favor for an application of established, albeit non Internet-specific procedures to network-mediated contacts. While it is unclear whether this argument is the actual reason, it can be observed today that there is no separate PIL specific to those many issues raised and discussed in relation to contracts and the Internet.

Accordingly, PIL-related issues regarding Internet jurisdiction and risk for electronic businesses in the Internet are discussed in [101] in a comparative way, integrating PIL notions originating from the EU, US, and China. The study focuses on service provider market activities that might substantiate jurisdiction in either of these three regions mentioned. Its main holdings are determined as follows: First, Internet jurisdiction was for a long time, and still is, a topic of concern from both, a legal and a technical perspective. Despite a long track of scientific discourse and precedence available in some jurisdictions, no single, internationally consistent understanding of relevant connecting factors has emerged. Even within a jurisdiction, there is not always an agreement based on what facts jurisdiction is substantiated. Second, the situation tends to be even more diverse when focusing specifically on Internet jurisdiction. There is, for instance, considerable criticism about those Zippo, effects, and targeting tests mentioned. Third, a service provider sees considerable risk today when providing an electronic service commercially in the Internet. Legal uncertainty, *e.g.*, with

respect to long-arm jurisdiction, prevails so that it is highly challenging — if not impossible — for a service provider to assess which activity in or targeting a market might substantiate jurisdiction in that market.

## 2.7 PIL in International Service Contracts

With the contractual, service-related, and PIL-oriented scope introduced, this work looks at an automated, legally compliant determination of jurisdiction and applicable law. At the point of contract conclusion, both parameters are mainly important from a risk assessment point of view. Should a dispute arise from a concluded international service contract and should this dispute be brought into court, that court would then first assess whether it has authorization to hear the case and to decide about it. If that court sees itself responsible, then the law applicable to the case in question needs to be determined. This might be the law of the state in which that court is located, but it might also be the law of another, foreign state.

Coming back to the moment of contract negotiations, service provider as well as service customer have an interest to know about where to direct potential claims and under what law such claim shall be investigated. The problem, however, is that contract parties are not always and under all circumstances free to make a choice of jurisdiction or to make a choice of law. So, the meaning of risk assessment at contract conclusion is whether any jurisdiction-/applicable law-related provision included in a contract is valid (or voided) should a claim be deposited at a specific court. Accordingly, Section 2.7.1 provides detailed insight into those procedures that a court might apply upon a claim related to an international contract was deposited. Section 2.7.2 looks at the current status and existing work in expressing such procedures of PIL in a formal manner.

### 2.7.1 International Contract Claim Procedure

In order to assess the impact of jurisdiction and applicable law better, those procedures by which a Swiss court would handle an international contract claim under the Swiss[5] federal PIL (IPRG, [19]) have been modeled in previous work [100]. Figure 2.5 depicts the according result as an activity diagram. At the event of an international contract claim being deposited at a Swiss court, that court would collect a basic set of connecting factors by which a contract with international relation is bound — connected — to the respective set of jurisdictions. By means of these jurisdictions supposedly showing a connection to the case, the respective applicable PIL or PILs is/are determined.

For a case, in which a service provider has only connections to state X, and a service customer has connections to only Switzerland, the court would see whether there is a supranational PIL to cover international relations between X and Switzerland or, if this is not the case, it would consider the IPRG as the applicable PIL (the applicable *procedural* law, that is). In this context, it is important to note about the difference between procedural and material law. At this point in the procedure, a court focuses only on which procedural law to

[5]The Swiss PIL constitutes an example case from a European perspective. The accordingly modeled procedure of an international contract claim remains essentially the same in other European jurisdictions, while it may see changes in minor details.

apply. PIL is part of procedural law as it tells, in simplified terms, what procedure to follow, but it does not go into substantive matters (instead, it refers to material law).

Under the assumption that the IPRG is the PIL of relevance, the court would apply the IPRG in order to answer questions of jurisdiction and applicable (material) law. Both questions depend on the knowledge of the IPRG-specific set of connecting factors. Once these are collected, the court is enabled to decide whether it has jurisdiction and, if yes, under which applicable law a case shall be assessed. In case Swiss jurisdiction is given, the court would proceed with a material qualification of the international contract in question. In case Swiss jurisdiction is not substantiated by the IPRG, the court would deny a trial in this court and refer to foreign jurisdiction.

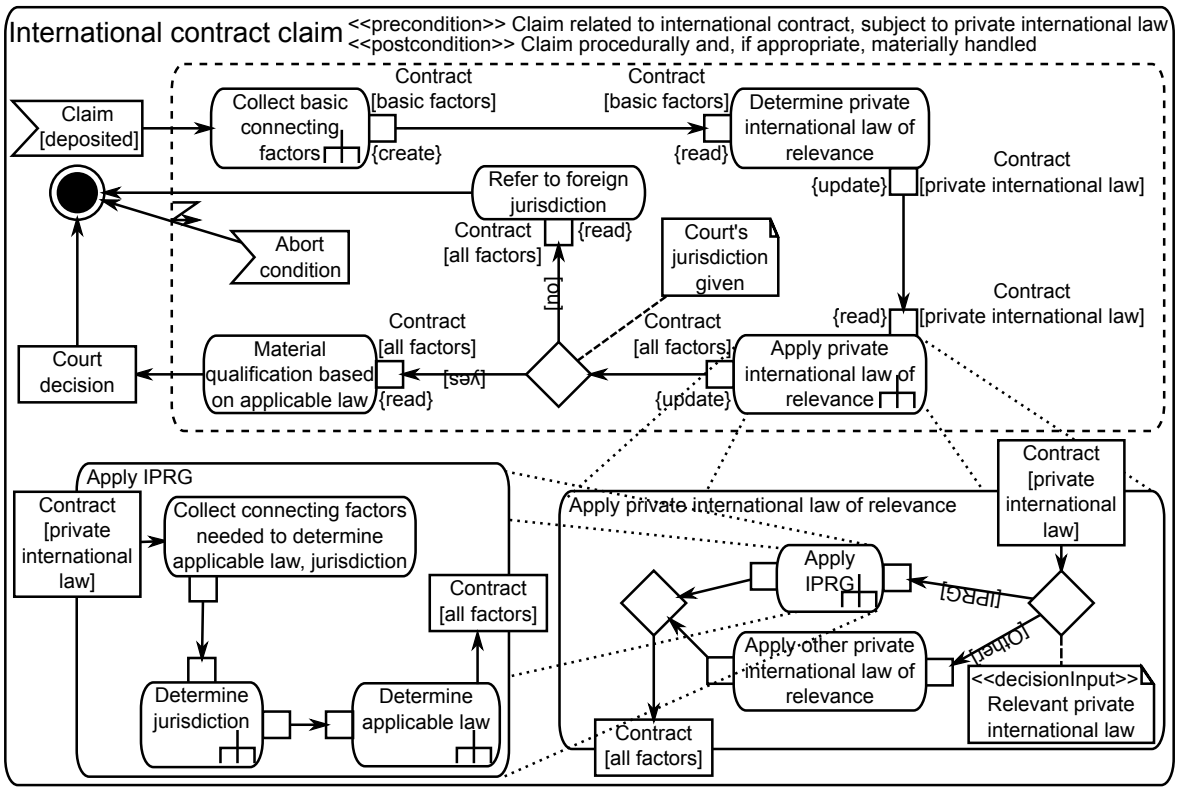


Figure 2.5: International Contract Claim Procedure [100]

The decision support system aimed at in this work is about an automated way to anticipate at the time of contract conclusion jurisdictions and applicable laws that have a good chance to "survive" the procedure described. In other words, recommendations on jurisdictions/applicable laws shall be determined and communicated to the contracting parties so that they can assess during negotiations where to reasonably attribute jurisdiction to and under what state's law. To this end, legal compliance is key. Thus, recommendations have to consider the relevant set of provisions originating from the respective PIL(s) applicable to a contract to be concluded.

### 2.7.2 Formal Representation of PIL

In the absence of directly related work, this thesis endorses a real pioneering effort in modeling and implementing PIL(s) applicable to international service contracts. To the best of current knowledge, there is no comparable methodology or a system available or under development. The only albeit loosely related work consists of partial work flows modeled for, *e.g.*, the Swiss IPRG [79].

Books like this include tables and work flows reflecting major cases while covering the complete law. However, such sources do not necessarily constitute better suited basis than the actual law it is about for a number of reasons:

- These books embrace typically an entire law, whereas a single included work flow often is summarizing and abstracting away details. In contrast, as shown in Section 6.3, only an excerpt of law sections is of relevance to this work usually. The part of relevance, however, must be analyzed in great detail.

- Books addressing laws of different jurisdictions typically do not follow a common methodology to model work flows, nor is the modeling method documented in any way.

- A PIL is by nature not written with automation in mind. It addresses experts in the field, not computer science. By that, human interpretation is expected instead of machine-execution. Work flows of such books imply the same audience of jurists as their main audience so that they do not offer any benefit with respect to automation purposes over a PIL source.

In the same way, PILs (and work flow books about PILs) assume the existence of a dispute out of an international contract. This work, however, looks at the time of contract conclusion at which, by definition, neither contract party has knowledge about any potential dispute, about whether such dispute might end in court, and about who acts as a claimant and who is defendant. Accordingly, all PIL provisions which base on the assumption of a dispute must be time-wise ported back to the respective knowledge of contract parties at contract conclusion.

In the light of a modeling and implementation methodology lacking, a preliminary modeling method has been determined and documented in [103]. This method was applied to the two major European regulations for jurisdiction and applicable law, the Brussels I [26] regulation and the Rome I [37] regulation, respectively. This led to two activity diagrams modeled, whereas Figure 2.6 shows the respective diagram for Brussels I.

As can be seen in Figure 2.6, several actions and decisions have to me made in dependence of dispute-driven information. For instance, decision b26 is in relation to the role of a defendant. Hence, one of the primary modeling method requirements to be met in this work is to develop a methodology which overcomes any dispute-related provision. Furthermore, the preliminary method determined in [103] apparently does not consider different notions of jurisdiction. As there is not only a single jurisdiction, but potentially multiple jurisdictions at different levels of content and relevant to either or both contract parties, the according concept of jurisdiction has to be strengthened in the methodology developed in this thesis.

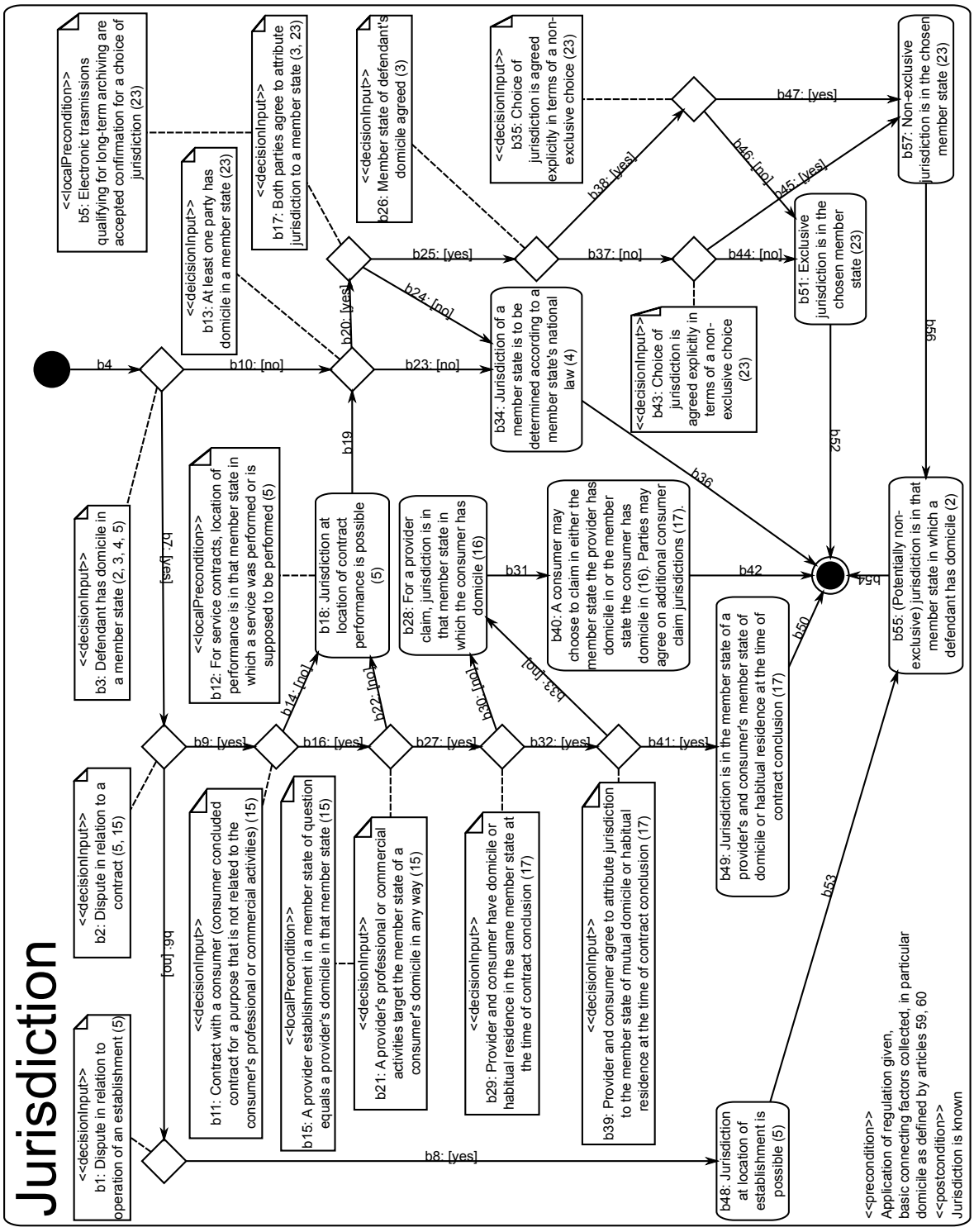


Figure 2.6: Activity Diagram for Brussels I Under Application of the Preliminary Method [103, 100]

## 2.8 Decision Making Support

Driven by the motivation outlined, service providers and service customers are interested at the time of contract conclusion in knowing about jurisdiction and applicable law recommendations that suit the relevant set of specific connecting factors and that take the relevant set of PIL procedures into consideration. Hence, the DeRISC implementation envisioned in this work constitutes a decision support system producing PIL-oriented recommendations which contract parties then might or might not consider for a given international service contract to be concluded. This section, accordingly, presents key selected methods and solution paradigms for decision support.

### 2.8.1 Decision Support Systems

Decision support systems have a long tradition in computer science. They are typically closely related to problem solving and reasoning with respect to complex and unstructured challenges. [80] gives a comprehensive overview of how the notion of decision support systems and their components evolved over time. The authors summarize that decision support "*tool design is comprised of components for (i) sophisticated database management capabilities with access to internal and external data, information, and knowledge, (ii) powerful modeling functions accessed by a model management system, and (iii) powerful, yet simple user interface designs that enable interactive queries, reporting, and graphing functions*".

Out of these three typical component areas, the first component is mapped to this work primarily by means of connecting factors expressing contract- and service-specific information. The set of relevant connecting factors forms the fundamental data set, based on which recommendations on jurisdiction and applicable law may be determined.

The way these recommendations are produced is reflected by the respective procedures defined by the set of relevant national or supra-national PILs that may show connection with an international service contract to be concluded. As motivated previously, in the lack of a modeling method for formal representation of a PIL, the modeling aspects gains central weight in this work. Hence, the second component of decision support systems listed in [80] is of key importance here.

Similarly, the third component of querying and result production is reflected by this work. This is related, on the one hand, to the actual reasoning and problem solving process. Reasoning and problem solving constitute the two core functionality dimensions implemented by a rule-based system and logic programming (*cf.* Section 2.8.2). Hence, the decision support system envisioned, DeRISC, is implemented as a rule-based system. On the other hand, it depends on the respective expressiveness made available by the information modeling technique used (*cf.* Section 2.8.3) resulting in information concepts and artifacts — the latter reflecting connecting factors from a PIL point of view.

### 2.8.2 Rule-based Systems

Determining recommendations on jurisdiction and applicable law for international service contracts is a highly complex task mainly because of two reasons: First, recommendations depend on the case-specific set of connecting factors. Connecting factors may show interdependencies. Second, procedures and the relevant set of connecting factors are determined

by those PILs that show supposedly a strong connection with a considered international service contract to be concluded.

Consequently, the PIL-compliant identification of suited jurisdictions and applicable laws is a cumbersome process — irrespective of whether it is carried out manually by human experts or in an automated manner. The design and implementation of an automated decision support system was suggested to lead to efficiency gains if imposed *ex ante* transaction costs are lower than *ex post* transaction cost optimizations (*cf.* Section 2.5). Beyond this argument, automation may provide substantial benefits also in terms of minimizing the potential of human error and in stream-lining interpretation degrees (*cf.* Section 2.7.2) to a certain extent.

Hence, the approach proposed foresees implementation by means of a rule-based system for automating the decision making process when determining jurisdiction and applicable law recommendations. Rule-based systems, also know as expert systems [107, 46], constitute a simple form of artificial intelligence in which the knowledge of human experts is encoded in the form of rules. These are conditional statements that link given conditions to actions — `if <condition(s)>, then <action(s)>` — where the left part is known as the premise and the right part as the outcome.

The two basic components of a rule-based system are the knowledge base and the inference engine [2]. The former stores specified rules and a set of facts (assertions about properties or relations), and the latter controls the application of the rules given the facts that hold at run time, *i.e.*, determines when a particular rule should fire. In contrast to procedural programs, the control flow in rule-based systems is chosen by the run time system and the facts that hold at a given point in time, instead of a predefined algorithm. Furthermore, knowledge in RBSs is not embedded in a program, but it is maintained separately in a knowledge base. The advantages of this approach are that knowledge can be maintained fairly easily by refining, or adding rules, and the core program does not require recompilation in the case of knowledge changes. The applications of rule-based systems vary from simple e-mail filtering, to diagnosing medical problems [81] and configuring network firewalls [3].

### 2.8.3 ITSM Information Model

As the reasoning procedure for an automated PIL-compliant determination of jurisdiction and applicable law recommendations bases not only on procedures defined in a PIL, but also on the accordingly available knowledge base of connecting factors, a common and consistent information modeling of key information concepts and artifacts is required. Consequently, the development of an information model reflecting key requirements of international contracting and electronic service management constitutes a task of central importance to this work. This information model shall link the analysis and modeling of PILs with the rule-based implementation. It thus serves as an important basis for a successful implementation of the DeRISC decision support system for the determination of jurisdiction and applicable law in the context of international service contracts.

According to [87], having an information model generally provides, amongst others, the following benefits:

- It allows for simplification of information management by providing a common terminology and reducing unnecessary variation.

- It allows for unification of information both within an enterprise (provider) and between enterprises (providers).

- It provides a bridge between the business and information technology groups by providing definitions that are understandable by the business, but are rigorous enough to be used for software development.

In addition, with respect to the specific goal of developing automated decision support in the area of international service contracts, the information model can be seen as a solution enabler. It clearly defines the required information objects, attributes and dependencies that are relevant for the information exchange between different components of DeRISC.

Due to a scope outlined in electronic services, the starting point in developing this information model constitutes in a comprehensive existing information model [77] that focuses on Service Level Management (SLM) — an ITSM discipline dealing with different kinds of agreements and contracts between IT service providers and its customers and suppliers, as well as service catalogs and reports. SLM is not only considered one of the most important ITSM processes (in a process-oriented IT service management system), but it is also closely related to the topics covered by this thesis.

This information model has been reused, adapted and extended in order to ensure that it reflects all relevant aspects mentioned in Section 2.7. It consists out of two components: a concept model and a model of the set of information artifacts. Both sub-models are represented as UML class diagrams. The concept model can be seen as the result of a first, high-level approach in identifying the most important domains, objects and outputs of an SLM process. Both the concept model and artifact model are presented and explained, together with a set of necessary assumptions, in Chapter 5.

## 2.9 Discussion and Gap Analysis

Driven by the overall scope definition determined in Section 2.1, those many considerations made throughout Sections 2.2 to 2.8 have introduced and documented the applicable understanding of relevant key terminology and mechanisms in law, technology, and economics. These three thematic dimensions have been inter-related in multiple ways to express in full detail to what extent challenges originating in the law dimension constitute the main driver for this work, in what terms technology constitutes the instrument to address these challenges, and by means of which reasoning effects with respect to efficiency out of an economics perspective are considered. In the same order of dimensions touched and scope areas determined as shown in Figure 2.2, the set of preliminary conclusions drawn is outlined in Table 2.3.

Out of those conclusions listed in Table 2.3, two fundamental notions have to be emphasized as introduced previously, namely the applicable understanding of the contract type focused as well as the underlying notion of a service. As for the former, contracts of electronic services are looked at exclusively. Services are assumed to be provided commercially, *i.e.*, for monetary compensation between a single service provider and a single service customer. For details of the envisioned contractual relationship and the related information model refer to Section 5.1.

Of note here is that, in general, the contractual relation focused is a bilateral (as opposed to a multilateral) one. Furthermore, relations are assumed to have an international (as opposed to intra-national) connection. The contract itself shall endorse a civil and commercial matter. Thus, a contract under private law is envisioned. Private law is typically differentiated from public law, including international public law (often referred to as international law), and from penal law (also referred to as criminal law). From a legal systematic perspective, the type of contract foreseen falls under PIL (also known as Conflicts of Laws[6]). The requirement of an international relation may imply international service provision (*e.g.*, between two customer offices) or it may mean that contract parties have international connection (*e.g.*, by means of domicile in different nations).

With respect to the contractual object focused, services are envisioned to embrace electronic provisioning of the contracted object exclusively. Purely electronic provisioning of the contracted electronic service implies that a service performed does not include any physical or material good at all. Consequently, legal sources considering material goods are excluded. Any considered PIL must be applicable to contracts covering the contractual object focused. The main reason for this selection is to narrow scope on to those services which are exclusively virtual in the sense of non-material, *i.e.*, services which are at the core of "Internet services". By this specific, narrowed service scope, an equally narrow scope is outlined for "Internet contracts".

These notions of service, contract, and legal systematic perspective constitute the core terminology applicable throughout this thesis. Therefore, all subsequent chapters adopt the respective understanding of those terms introduced and discussed in Sections 2.2 to 2.8 and summarized in Table 2.3.

Considering the inherent risk of long-arm jurisdiction, costly legal counsel, and complex decision processes in the conclusion of international service contracts, the need for the DeRISC decision support system to produce recommendable jurisdiction(s) and/or applicable law(s) becomes apparent, especially for SMEs (Small and Medium-Sized Enterprise) that might not have strong legal workforce at hand. DeRISC is expected to provide for increased legal certainty, *i.e.*, better expectations about a potential dispute, namely that such dispute would be settled by a court which is accepted and feasible, and under the laws of a nation which are accepted and feasible.

Considering the lack of directly related work for an automated, PIL-compliant determination of jurisdiction and applicable law recommendations at the time of contract conclusion, the work focused in this thesis constitutes a true pioneering effort. Given the inherent complexity of procedures in PIL, however, the set of claims and objectives identified in Section 1.1 has to be addressed in a comprehensive, most structured manner. In particular, the following gaps in concepts, models, and implementation as determined throughout this section have to be met:

**Gap 1: Information model, modeling method, and implementation** — The analysis of state-of-the-art in those areas of scope considered has revealed that there are substan-

[6]The performed analysis of major legal traditions in the world results, on the one hand, in the acknowledged risk of unresolvable conflicts among these traditions still today. On the other hand, an integrated perspective on matters of commercial law — such as a common understanding of a contract — was found more likely to prevail in many legal traditions. This common ground on commercial law is essential to anticipate the significance and acceptance of a decision support system as foreseen in this work.

Table 2.3: Overview of Preliminary Conclusions Drawn per Thematic Dimension and Scope Area

| | Scope | Conclusion[a] |
|---|---|---|
| Law | ⑨ Legal system | Territoriality and state sovereignty are well established principles that are not foreseen to diminish in weight and importance in the near future. |
| | | Conflict of laws and PIL are issues of primary relevance in international business transactions as of today. |
| | | In the Internet, self-regulation in terms of PIL issues did not happen nor did a specific PIL regulating „Internet contracts“ or „Internet services“ emerge. |
| | | The systematic introduced so far reflects primarily prevalent continental European terminology. |
| | ⑧ Contractual focus | **International connection** is assumed. |
| | | International connection may relate to service provisioning aspects and/or to contract party-related connecting factors. |
| | | A contract of **civil and commercial matters** is assumed. |
| | | A **bilateral** contract is assumed. |
| | ⑦ Field of law | **Private law** relevance (as opposed to public or penal law) is assumed. |
| | | In private law, **law of obligations** relevance (in continental European terminology) is assumed. |
| | | In law of obligations, the phase of **contract formation** is focused. |
| | | In law of obligations, a **service contract** (contract type) is assumed. |
| | | In private law, **PIL** (near synonyms of conflict of laws, international private law) relevance is assumed. |
| | | In PIL, **jurisdiction** is focused. |
| | | In PIL, **applicable law** is focused. |
| Technology | ⑥ Automation | Automation in determining jurisdiction/applicable law recommendations is focused. |
| | | Automation follows the principle of legal compliance with the respectively modeled PIL(s), whereas a certain degree of interpretation during PIL formalization is to be expected. |
| | ⑤ Management Function | Service and contract management functions are focused. |
| | | As managed object, an **international service contract** is assumed. |
| | | The managed service is assumed to be purely **electronic** (*i.e.*, no involvement of material goods). |
| | | The managed service is assumed to be **commercially** offered. |
| | | Primarily value-added electronic services are focused. |
| | ④ Decision support tool | Typical characteristics of decision support systems are observed, in particular with respect to complex problem solving and partly unstructured procedures. |
| | | Typical decision support system components (knowledge base, modeling aspect, interactive querying) are focused. |
| Economics | ③ Transaction costs | Decision support by means of jurisdiction/applicable law recommendations made available during contract formation is deemed successful in economic terms in case it lowers total transaction costs for contract parties. |
| | | Transaction costs in PIL-compliant international service contracting are particularly high mainly due to prevailing uncertainty and a high specificity level. |
| | ② Contract/ Service life cycle | A trade-off between *ex ante* and *ex post* transaction costs is to be expected. |
| | | Contract parties are interested in obtaining reliable information on jurisdiction and applicable law at the time of contract formation. |
| | ① Risk management | In electronic business in the Internet, risks of long-arm jurisdiction, forum shopping and similar PIL-related issues prevail. |
| | | An assessment of PIL-related risks involved along the contract/service life cycle at the time of contract formation is difficult to achieve. |

[a] MUST criteria in bold face

tial gaps (a) in a common information model considering dimensions of service and contract management, (b) in a lacking method to identify, analyze, and formally model a PIL of interest, and (c) in a decision support system implementation helping contract parties by means of reliable recommendations on jurisdiction and applicable law. These three components (a) to (c), hence, constitute the key set of major contributions focused in this work.

**Gap 2: Applicable notion of service and contract** — The modeling method, the implementation, and especially the information model shall consider and reflect concepts

as well as concrete information artifacts in relation to the type of service (purely electronic services for monetary compensation) and contract (bilateral international service contract under PIL) assumed here. Moreover, the contract type of a service contract shall be investigated and characterized in detail. The comprehensive analysis and emulated contract qualification of a service contract as performed in a separate case study shall provide for a fourth major contribution of this thesis in addition to the information model, modeling method, and implementation.

**Gap 3: Consistency and compliance** — In particular the modeling method, but also the information model and the implementation, shall consider and reflect characteristics of PIL procedures. This implies, for example, a time-wise back porting of dispute-dependent PIL provisions to the time of contract conclusion. Overall, legal compliance and content-wise consistency with a law to be modeled are key issues while interpretation, albeit not completely avoidable, shall be kept to a minimum.

**Gap 4: Extension of the existing information model** — The information model is important to inter-link modeling method and implementation. As such, the existing SLM information model provides for a well-suited, established basis for model extensions. Model adaptations are mainly needed to reflect both, service and contract management dimensions.

**Gap 5: Rule-based system** — The implementation shall adopt a rule-based system-driven approach, as rule-based systems show advantages in building expert systems addressing decision-based procedures that are characterized by high complexity. Hence, with the help of a knowledge base, a modeling result consisting mainly of conditions and actions, and the inference engine, the DeRISC decision support system as introduced and motivated shall be implemented in logic programming.

This list of gaps identified is understood to complement and further concretize the set of claims and objectives raised. The accordingly determined measures to address these gaps provide, on the one hand, input to the research methodology presented in Chapter 3. On the other hand, they are part of the overall assessment of achievements made — measured in terms of gaps addressed — presented in Chapter 7.

# Chapter 3

# Research Methodology

The chapter at hand details on methodological aspects relevant to this thesis. The developed methodology is influenced by the set of five gaps identified. These gaps define the range of contributions this thesis foresees (gaps 1 and 2), namely an in-depth understanding of service contracts gained by a case study as well as the according information model, PIL modeling method, and implementation. Consequently, the methodology determined covers (information and PIL) modeling as well as implementation aspects, and the case study methodology is outlined.

How the methodology is shaped in detail depends on two factors. On the one hand, gaps 3 to 5 require the modeling and implementation methodology to consider consistency and compliance with the underlying legal basis, to draw the information model as an extension to an existing model, and to implement the envisioned decision support system DeRISC (Dispute rEsolution Recommender for International Service Contracts) as a rule-based system. On the other hand, the methodology is shaped by a number of key challenges identified.

Accordingly, these challenges are explained in terms of which ones are addressed partially or fully in this thesis. This is followed by an introduction to the overall modeling and implementation research methodology which follows a design science approach. These considerations are complemented by an outline of the accordingly developed methodology to apply to an international service contract case study.

## 3.1 Key Challenges

This thesis aims at the design and implementation of a decision support system, DeRISC, to facilitate an automated and PIL-conforming determination of jurisdiction and applicable law recommendations for international service contracts. Overall, this can only be achieved if those challenges of generalization, completeness, abstraction, and value shown in Figure 3.1 are satisfied.

As Figure 2.5 revealed, a generally applicable base set of connecting factors needs to be collected (i) initially. This base set reflects the fundamental facts of an international service contract to be concluded. These facts originate from both, contract parties and from the service considered for contract conclusion. According to the respective base connecting factor setting found in (i), connection(s) to legal domain(s) are identified. Once these connections are available, the relevant national or supra-national PIL may be determined (ii). Thus, the

result of (ii) is dependent on (i). On the other hand, (i) — in terms of integrated base of connecting factors to be considered in the first place — depends on (ii) as well. The number of national and supra-national PILs modeled defines the range of connecting factors supported in principle in (i). The directly comparable inter-dependency prevails between (ii) and (iii) as well as between (ii) and (iv). As soon as the relevant PIL is determined (ii), the accordingly applicable set of PIL-specific connecting factors is identified (iii). (iii), thus, logically depends on the range of PILs supported. The PIL-specific connecting factors of (iii) constitute the main input parameters to (iv), the automated determination of jurisdiction and applicable law recommendations. Consequently, the set of key challenges is identified as follows:

**Generalization** — Based on the set of supported PILs, those PIL-specific connecting factors need to be identified that are needed to decide in (ii) which PIL finds application to an international service contract under consideration. As these PIL-specific connecting factors originate from different PILs, they need to be integrated so that the respective notion of, *e.g.*, domicile in PIL X fits the corresponding notion of domicile in PIL Y. In other terms, those connecting factors qualifying for inclusion in A need to be represented in generalized form, making them applicable to multiple PILs.

**Completeness** — The range of national and supranational PILs reflected impacts the expressiveness of (i), (iii), (iv) — and indirectly even the expressiveness of (ii) by ways of (i). The more PILs are supported, the more connecting factors, the more connecting factor settings, and the more contractual arrangements can be accommodated. On the other hand, increased completeness in PIL support results in higher complexity in determining jurisdiction and applicable law. This is due to the fact that every jurisdiction might have its own PIL, whereas the number of PILs on a supra-national level might be even less clear.

**Abstraction** — Different connecting factors obtain a different weight among different PILs and among different thematic sections within a single PIL. For instance, the connecting factor of domicile is of central importance to most PILs in continental Europe. In contrast, the collection of nations in which a service under consideration was promoted might be of importance in consumer contracts (B2C), while this connecting factor does not usually play an important role in contracts between professional service providers and professional service customers (B2B). Furthermore, not every provision in a given

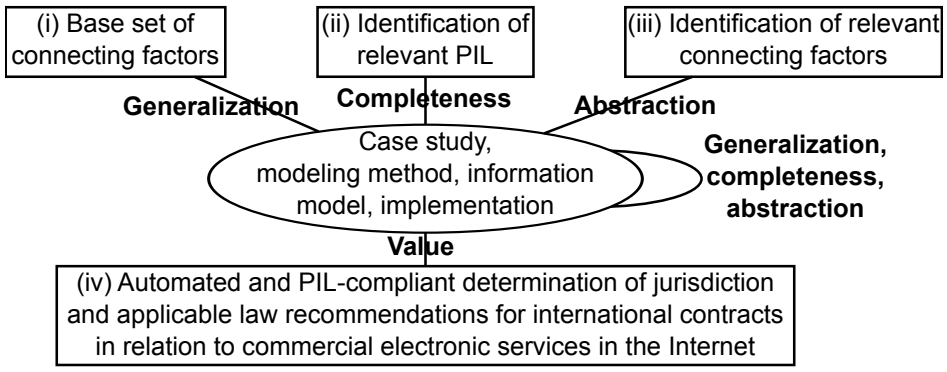


Figure 3.1: Key Challenges of Generalization, Completeness, Abstraction, and Value

PIL is attributed the similar impact on the overall process to determine jurisdiction and applicable law. Consequently, the right level of abstraction has to be found. This work aims to determine jurisdiction and applicable law recommendations in a legally compliant way. However, it will have to focus on automation and modeling of those provisions that show significant weight in the overall process. This implies that aspects of secondary weight — such as reservations — are abstracted.

**Value** — The DeRISC decision support system to determine jurisdiction and applicable recommendations in a PIL-compliant and automated way needs to create value added providing incentive for service providers and service customers, *e.g.*, by means of lowered total transaction costs through informed choices. With that, incentives to replace the legally often non-compliant, static way jurisdiction and applicable law is determined today shall be given. In other terms, the respective adoption cost-benefit ratio needs to be a positive one. This is in direct dependence of those previously outlined challenges of generalization, completeness, and abstraction. There is a trade-off between value added and each of these challenges. For instance, if the level of abstraction is too high, a lower value is to be expected, since DeRISC then would miss its primary claims (see Section 1.2) — in particular claims 2 and 4 of increased legal certainty and a better risk assessment.

These challenges listed have been identified based on the background information outlined in Chapter 2. In particular, procedures of PIL in relation to international contract claims (*cf.* Figure 2.5) have contributed to the set of challenges. For practical reasons of limited resources, not all discussed aspects (i) to (iv) may be addressed in the similar, fully detailed level. In this light, Section 3.2 explains to what extent the set of four major contributions — case study, information model, modeling method, and implementation — addresses these challenges discussed here.

## 3.2 Scenario-driven Modeling and Implementation Methodology

The underlying scenario for this thesis covers a service provider and a service customer. Both parties are in the process to conclude a contract in relation to an electronic, commercial service. This service contract is supposed to show an international connection since contract parties are assumed to be connected to different jurisdictions and/or the respective service is assumed to be provided internationally. The accordingly developed Figure 3.2 visualizes this scenario by means of two actors — service provider and service customer — taking part in the according use case for international service contract conclusion.

The scenario goes on to suppose that both parties would like to know about jurisdiction(s) and/or applicable law(s) that fit(s) the specific contractual agreement they are about to conclude. This is to inform and prepare for the case a dispute would arise from the contract concluded. In order to retrieve jurisdiction- and/or applicable law-related recommendations both sides submit the respective set of connecting factors, upon which they obtain a list of recommendations compiled according to the PIL(s) of supposed relevance. Figure 3.2 accordingly depicts the scenario by means of three use cases embraced. The main use case

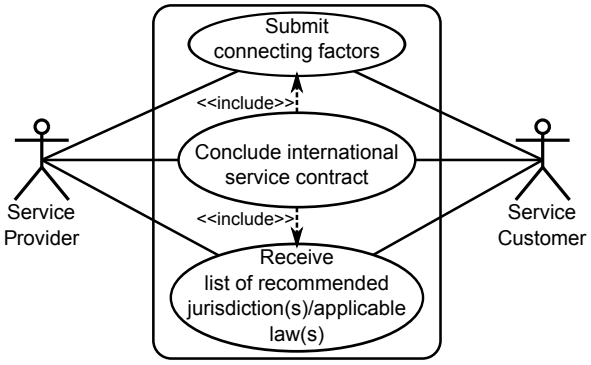


Figure 3.2: High-level Scenario with Use Cases

reflects the scenario directly. It represents the conclusion of an international service contract as described. This use case includes two use cases. The first reflects both contract parties in submitting the relevant set of connecting factors. The second reflects both contract parties to receive the accordingly produced list of jurisdiction and/or applicable law recommendations.

Given this scenario, the PIL procedure explained in Section 2.7, and the set of challenges discussed previously, the overall target of automated jurisdiction/applicable law recommendations has been determination to require the set of the three steps presented in Figure 3.3 [100] to be modeled and implemented. The first step consists in identifying potentially affected jurisdictions by an international service contract to be concluded. This should happen in the same way a court dealing with a PIL-oriented claim would proceed. A court would collect basic connecting factors and determine on this basis jurisdictions with potential connection. In the contract conclusion case, such procedure is to be reflected by the contract parties to submit the respective set of contract party- or service-specific connecting factors of interest. A complete implementation would take these factors in consideration and produce a list of supposedly connected jurisdictions. For each jurisdiction identified, the set of relevant PIL sources is determined. Criteria for PIL selection would be related to application of a PIL in question, namely whether a law applies to a case in question (material application), whether it is in force for the time frame in question (temporal application), whether it applies in the location or locations touched (geographical application), and whether it supersedes other PILs or is subsidiary to another PIL (hierarchical application).

In step 2, each PIL identified would need to be reflected by a formal model (*e.g.*, in terms of an activity diagram; one diagram per PIL), which would then each be implemented in order to produce jurisdiction/applicable law-related output. Modeling, implementation, and output generation all base on a common information model as well as a common modeling and implementation method. By every new PIL modeled, common parts might need to be altered in order to reflect so far non-covered aspects. Updates in the information model and the method are expected to tend less frequent with the number of already modeled PILs. Moreover, changes in the underlying information model might provoke an update in the set of basic connecting factors to be collected during step 1. Issues in this context concern the list of connecting factors to be covered. This is of utter importance since if an important connecting factor is missing in the first place, a relevant jurisdiction (and related PILs) might not be investigated at all.

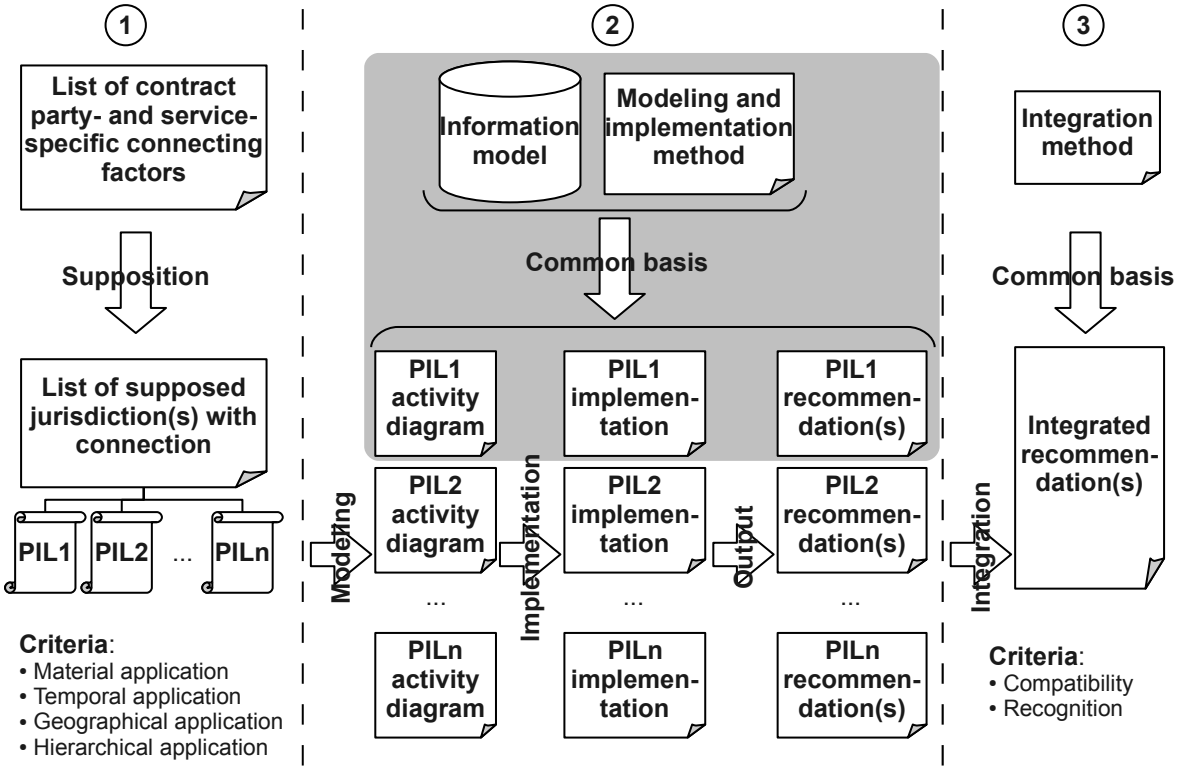


Figure 3.3: Overall Three-step Procedure and Focus Area (Grey Background)

A list — one list per PIL considered — of recommended jurisdiction(s) and/or applicable law(s) is produced in step 2. These lists constitute the main outcome of this step. The procedure, however, cannot end here. Contract parties should obtain additional information with respect to compatibility of the different recommendations. Due to a territorial principle in law (state sovereignty) there is no mechanism in place, *per se*, that guarantees consistency (in terms of compatibility) within jurisdiction/applicable law provisions originating from different PILs. There are multiple scenarios to be assessed, and for each a mitigation strategy is to be developed. For instance, two lists reflecting two PILs might be overlap-free. In this case, it remains unclear which recommendation to choose over another. It is even unclear whether one may be ranked higher than another. In other scenarios, there might be partial overlaps of recommendations. Similar questions would apply here. Even a case which is probably less complex, such as the case where one list is completely embraced by another (sub-set of jurisdictions/applicable laws), is not completely deterministic. Only in cases where a single list of recommendations is produced — a case, however, which is rather unlikely as it is a very special case — or in case multiple lists are fully compatible (congruent lists) the mitigation strategy to adopt is clear.

At this point of discussion, contributions of this thesis may be placed and valued in the context of the overall picture sketched in Figure 3.3. Focus in this thesis is exclusively on the core of step 2, including several sub-steps (*cf.* area with gray background in Figure 3.3). In particular, a thorough investigation of how to formally reflect a PIL leads to substantial methodological contributions documented in Chapter 6. Methodology application is assessed for an example PIL modeled, the Brussels I regulation. The detailed modeling

method with respect to PIL identification, PIL selection, and law analysis is developed in Sections 6.2 and 6.3, respectively. Focus in this context is put on major cases meaning that the law analysis method includes aspects assumed to reflect typical circumstances while aspects such as reservations are not considered. The functional modeling method is completed by means of guidelines and criteria outlined for a successful PIL modeling (Section 6.4).

In addition to the modeling method developed, documented, and applied exemplarily to Brussels I, this thesis sees a major methodological contribution with regard to implementation. Sections 7.2 to 7.4 denote those guidelines and the set of specific criteria determined for a successful implementation of a previously modeled PIL by means of logic programming in Prolog. Even though an implementation is not fully deterministic, *i.e.*, it is dependent on a certain degree of interpretation, the concrete example of Brussels I shows that an implementation is feasible. Furthermore, implementation functionality is verified by means of a test case-based evaluation (Section 7.5).

## 3.3 Design Science Approach

Figure 3.4 visualizes the research methodology in relation to modeling and implementation phases. The methodology follows a design science approach (as opposed to a behaviorist approach) [48, 47] and is represented based on the method introduced by [39]. Accordingly, this work is mainly concerned with the design of artifacts and the contribution of scientific knowledge. In terms of the research object envisaged, a socio-technical focus on international service contract-related, electronic business-related transactions is taken. In this context, action system and information system artifact development is envisioned. The first reflects the work flows interpreted from PIL procedures to determine jurisdiction and applicable law. The second reflects the actual implementation in terms of DeRISC to enable an automated jurisdiction and applicable law recommendation determination for a service provider and a service customer at the time of contract formation.

In addition to action and information system artifacts, the key contribution — here in terms of knowledge contribution — consists, on the one hand, in the underlying design artifact developments of the respective information and work flow models, on the other hand, in a conceptual framework how to identify, analyze, and model multiple PILs as well as related service types in a technically and legally correct, economically efficient, and scalable manner. The information model and work flow model find expression in a formal language, namely in UML2 Activity Diagrams [69] (information model) and UML2 Class Diagrams as well as formally expressed rules (work flow model). The modeling and implementation method, *i.e.*, the applicable conceptual framework, finds expression in natural language.

The overall methodology bases on a central hypothesis and it follows a common purpose. The hypothesis adopted is driven by a service provider's and service customer's identified need for improved risk assessment along the complete contract and service life cycle with respect to international service contracting. The automated, legally compliant determination of jurisdiction and applicable law recommendations for international service contracts shall reveal increased predictability and legal certainty for both contract parties.

Driven by this purpose and hypothesis, the key suitable justification criterion of relevance here is to show adequacy. This embraces core results, in particular the implemented action system and the set of defined artifacts (IS artifact, information and work flow models). The

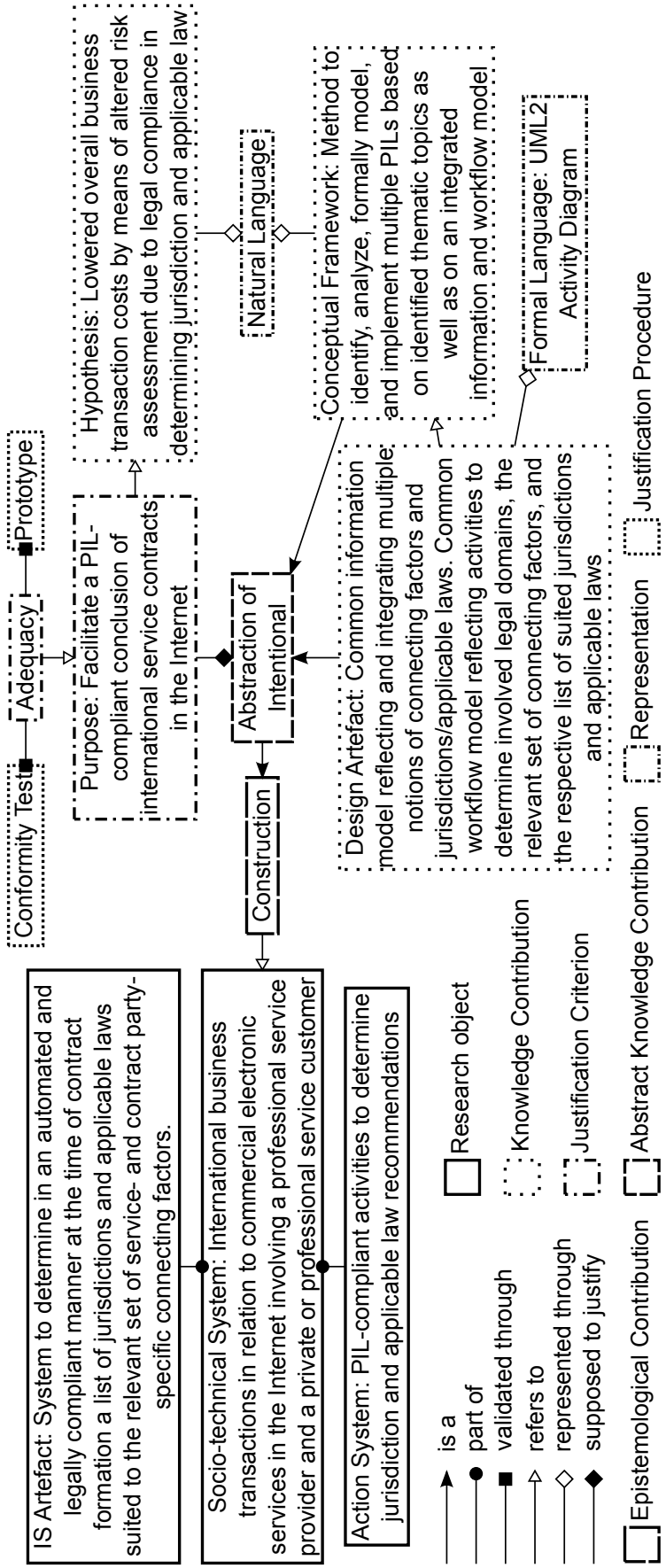


Figure 3.4: Research Methodology

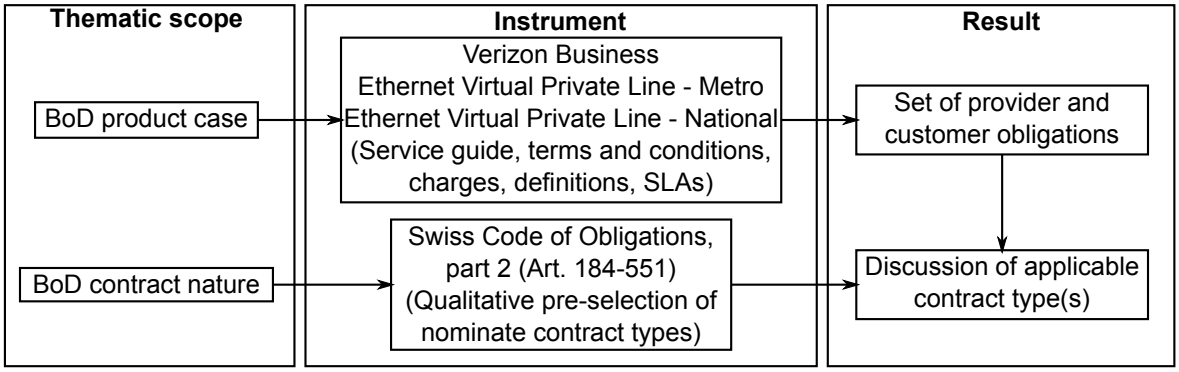


Figure 3.5: Case Study Methodology (Adapted from [103])

main means to show adequacy foresees conformity tests in terms of a comprising set of comprehensive test cases covering multiple connecting factor configurations.

## 3.4 International Service Contract Case Study Methodology

In order to develop a comprehensive understanding of international service contracts, this work's fourth major contribution beyond information model, modeling method, and implementation, is found in an extensive case study to conduct a simulated contract characterization. The type of contract investigated is in relation to Bandwidth-on-Demand (BoD, *cf.* Section 4.1), while the contract qualification itself is simulated by means of nominate contract types of the Swiss code of obligations [18].

This task translates into the specific methodology developed as shown in Figure 3.5. The investigation in a BoD product case is conducted by means of a real-world BoD product offering. The BoD product family looked at in detail is termed Ethernet Virtual Private Line (EVPL) [92] as offered by Verizon Business. EVPL includes two variants with a BoD feature set, EVPL-Metro and EVPL-National. EVPL-Metro and -National embrace each a number of value-added as well as basic communications services. Even though the primary focus within this work is on contracts of value-added electronic services — which is in-line with the respective understanding of BoD as introduced in Section 4.1 —, basic services shall be considered in BoD contract discussions to a certain extent.

This means that both, value-added and basic services, are assessed from a contractual point of view as long as these services form integral part of a BoD contract. Within the scope of the BoD product case, this selection of considered services is driven by the applicable EVPL-Metro and -National service guides, respectively.

The number of commercially offered BoD products is limited. Even more limited is the number of BoD offerings with publicly available service description, policies, terms and conditions, and SLAs (Service Level Agreement). This is why this case study is conducted on a single BoD offering only. Although this specifically investigated BoD product is available in the USA, this thesis' focus applies the general technical views on a BoD contract in Europe. In the light of these geographical product availability limitations mentioned, the

considered existing product and its attributed policies, terms, and SLAs do provide insights to the purpose of a simulated BoD contract characterization under European contract law.

This BoD product case, thus, embraces the Verizon EVPL-Metro and -National BoD offerings. More specifically, it includes the study of the following instruments — all of which form parts of any customer agreement concluded between Verizon Business (in the role of a service provider) and a service customer:

**Service guide** — According to those product/service characteristics mentioned in the service guide, the services investigated are shortly described in terms of their main functionality. This information determines important input to results envisaged such as service provider and service customer obligations.

**Terms and conditions** — General terms and conditions are shortly presented with respect to the overall structure of contents and with a summary of precedence (hierarchy of different contract parts) as well as of those determinations in relation to applicable law and dispute settlement. Product-specific terms and conditions are presented with their main contents, while focus is on determinations governing service provider and customer obligations.

**Charges** — Recurring and non-recurring service and administrative charges are presented insofar as that the respective monetary compensation principles are explained. Detailed rates and charges in the sense of exact monetary values are not outlined, since these are presumably subject to more frequent changes than the underlying cost structure. The latter provides important insight into contractual obligations.

**Definitions** — General and product-specific definitions are not explained in detail. They are referenced to instead so that an interested reader is able to follow up on the applicable terminology.

**SLAs** — Available SLAs are presented with regard to those dimensions of guarantees offered by the service provider to the service customer.

The analysis of those instruments discussed (*cf.* Section 4.2) provides direct input to determine the respective service provider and service customer obligations (*cf.* Section 4.3). This set of mutual obligations identified constitutes the first major result of the BoD product case study. Moreover, it is a key input to the discussion of possible contract types (*cf.* Section 4.4). This discussion identifies the very nature of a BoD contract.

In addition to those results obtained from the case study, the instrument of a European civil law code of obligations is used, namely the Swiss code of obligations [18]. Particular focus is on part 2 of the code. It contains nominate contract types as listed in Table 2.2. Nominate contract types cover those contract types that, due to their impact in contracting, have seen specific codification beyond general contract law (as represented in [18], part 1). Some nominate contract types qualify for detailed discussion, while others can be excluded from discussion *ex ante*. Consequently, a qualitative pre-selection of qualifying nominate contract types is performed. Only these pre-selected types are further assessed.

The discussion of applicable contract types reflects the simulated contract qualification envisioned. Hence, service provider and service customer obligations in a BoD contract are analyzed with respect to a potential fit with respective contract obligations of any considered

nominate contract type. Simulated in this context does not relate to a technical simulation. It emphasizes on the fact that this qualification is based on a contract assumed, that the qualification is not conducted by a court, and — most importantly — that it abstracts away those presumably numerous details that a real case, *i.e.*, a not simulated qualification based on an existing contract is expected to show.

# Chapter 4

# International Service Contract Case Study

This chapter investigates a selected contracting case in B2B commercial electronic service provisioning, namely Bandwidth-on-Demand (BoD) in Europe. Driven by the identified gap of a detailed understanding lacking in the contract type applicable to an international service contract, the case study at hand performs a contract qualification using the example of a real-world BoD service offering. Based on an in-depth characterization of BoD from a technical perspective, the applicable nature of BoD contracts is determined and presented. This includes a detailed discussion of available contract bundling options and a simulated material contract qualification for the set of addressed service provider obligations covering network access, dynamic bandwidth provisioning, terminal equipment, and service as well as maintenance guarantees.

Accordingly, BoD is presented with respect to background information and an overview of the respective state-of-the-art provided. In accordance with the case study methodology introduced, the BoD product case study is conducted by means of two Verizon Business offerings, EVPL-Metro and EVPL-National including a dynamic bandwidth feature. This study includes the analysis of applicable service guides, terms and conditions, charges and SLAs, and it references the respective terminology definitions. Insights gained from this analysis are used to determine the key set of relevant service provider and service customer obligations.

Driven by these identified obligations, a detailed simulated BoD contract characterization becomes of key importance to determine a BoD contract's nature. To that aim, nominate contracts of the Swiss code of obligations are presented. After an introduction into the respective procedure to perform a contract qualification, a qualitative pre-selection of potentially relevant nominate contract types is carried out. This is complemented by a detailed discussion of applicable contract types including contract bundling options.

The insight gained from this contract qualification provides the fundamental contractual notion of an international service contract. The understanding of international service contracts constitutes an essential contribution made within this thesis. It is crucial to the remaining gaps to be addressed, since a common contractual notion underlies all further work in this thesis. In particular, the notion of an international contract as generalized from the performed case study is reflected by the information model developed for and adopted in this thesis. The information model, in turn, is reflected with its contractual notion and

the respective information artifacts by the accordingly designed and implemented decision support system DeRISC.

## 4.1 Bandwidth-on-Demand (BoD)

BoD relates on one hand to a set of mechanisms and business models, while on the other hand, it is often associated with specific technologies implementing BoD scenarios. With a focus on the respective mechanism of BoD, the term embraces an understanding of bandwidth as a commodity [20]. Bandwidth, thus, can be traded in the same way as those commodities of other infrastructure-related markets, *e.g.*, the market for electricity. In that sense, bandwidth trades are assumed to be based on contractual agreements [62, 20], which see technical implementations by means of SLAs defining specific Quality-of-Service (QoS) characteristics [6]. In addition to contractual implications, BoD as a mechanism is associated with a number of related economic aspects, such as price dynamics [6, 28, 57], auctions [27, 56], or path optimizations [20]. Within the scope of this case study, however, only contracts for BoD as such are emphasized exclusively.

Even though BoD as a mechanism requires a technical implementation and the underlying infrastructure to be in place in order to facilitate bandwidth trades, the mechanism itself is not limited to a specific type of technology or infrastructure. Today, BoD finds implementations, which are typically related to network service provisioning in conjunction with service guarantees and resource reservation [6, 12]. This embraces for instance the use of protocols like the Resource ReSerVation Protocol (RSVP) [17] and architectures like (Generalized) Multiprotocol Label Switching (MPLS [50], GMPLS [14]).

Technology independence of BoD in terms of a mechanism to trade bandwidth as a commodity is further reflected by the fact that BoD is applied even at the application layer, namely in P2P overlay networks. While BoD at the lower layers 1 to 3 in the ISO/OSI model is nowadays technology-wise often associated with Label Switched Paths (LSP) over optical links [15, 12], bandwidth was found to determine a typical resource for trade in P2P applications [31].

Based on that outline of different existing BoD notions provided and in accordance with those key issues determined, the term BoD is used within the scope of this work as follows: On one hand, BoD is considered as the mechanism to trade bandwidth as a commodity within the legal frame of a contractual agreement. This mechanism is technology-independent, *stricto sensu*, whereas potential dependencies, *lato sensu*, resulting from the underlying technology, are fully acknowledged. For instance, a BoD contract might include terms on quality levels specific to optical network equipment. Such contract elements are acknowledged, but not investigated in detail within this case study. On the other hand, the process of forming contracts for BoD constitutes the key issue here — in the sense that the characteristic nature of such contracts and, with that, of BoD itself needs to be determined. This includes in particular the identification of applicable contract types and a characterization of substantive contract elements.

One technical dependency, *lato sensu*, however, that needs to be investigated in further detail is determined by the respective timely relation between the mechanism of BoD and contract formation for BoD. The term Bandwidth-on-Demand implies a dynamic provisioning according to an expressed demand. [28] introduces so-called mixed contracts for BoD:

"*Under a mixed contract a customer is allowed to buy a fixed amount of resources ahead of time for a price a, the 'static' part of the contract, and complement this at each new time period by purchasing an extra amount at price b, the 'dynamic' part of the contract.*" This understanding is in principle in-line with the respective applicable understanding within the scope of this work. However, the underlying assumption in [28] of static and dynamic determinations forming parts of a single contract is argued upon. Such a scheme might prevail, but static and dynamic determinations might constitute self-contained contracts as well. In other terms, [28] takes one possible assumption here, while the very nature and structure of a BoD contract construct still remains to be addressed. Hence, those different ways to look at a BoD contract construct constitute a major object of discussion in this work.

BoD requires infrastructure and a basic network service to be in place. For the infrastructure, a separate contract might be needed to be concluded. In case the infrastructure and the basic network service are available, and if the underlying BoD technology facilitates an automated bandwidth provisioning a BoD contract may be formed in an automated fashion upon demand. The lead time required before an actual BoD provisioning is seen today as a critical success factor for BoD. Retrospectively, a long lead time for BoD setup is even considered as one of the main reasons why BoD failed to introduce bandwidth as a widely traded commodity in the late 1990s [55]. At that time, the underlying technology was not ready to support automated BoD setup in a short time frame. That technical dependency in conjunction with falling bandwidth prices inhibited wide market adoption of BoD. This has led to the introduction of control planes [55, 15] which handle connection setup based on control plane technologies, such as GMPLS. Accordingly, [12] relates current time dimensions of BoD contracts and the BoD mechanisms as that "*[...] the bandwidth contracts have an hourly timescale while the timescale of the trading mechanism is of the order of minutes*". Under such a setup and provisioning scheme — implying on the one hand the respective technical dependency, *lato sensu*, while representing state-of-the-art on the other hand — BoD contract formation is assumed to share the same short time frame requirement as the BoD mechanism. This means that automated and fast BoD — [89] mentions even a timescale of seconds only — implies automated and fast BoD contract formation. Therefore, not only the key set of applicable contract types and substantive BoD contract elements need to be investigated, but automated contract formation states the complementary field of investigation here.

In order to conclude, this case study considers the relation between BoD and BoD contracts as follows: A BoD contract constitutes a self-contained bilateral contract or a set of contracts governing conditions of BoD provisioning. In the latter case, the actual terms on dynamic bandwidth may depend on the existence of other self-contained or bundled bilateral contracts governing static, basic network access (network service contract) and/or infrastructure usage (network infrastructure contract). Even though BoD is understood as a technology-independent mechanism, it is assumed to be provisioned typically as an ISO/OSI layer 2 or 3 functionality making use of underlying technology that allows for automated configuration in the timescale of minutes or hours — which implies that BoD contracts should be formed likewise in an automated way and in the same or a more fine-grained timescale.

## 4.2 BoD Customer Agreement Components

In order to use either EVPL-Metro [93] or EVPL-National [94] a service customer has to conclude a contract with Verizon Business. This contract is termed customer agreement. It consists of several components, two of which are definitions of the applicable terminology. For EVPL-Metro and EVPL-National customer agreements, general definitions [95] and product-specific definitions [97] are available. From a contractual point of view, these definitions do not state direct obligations, whereas the applicable terminology has an indirect impact on obligations. For instance, the product-specific definitions determine the applicable understanding of full bandwidth and point-to-point service. As these terms are referenced from other components of a customer agreement, *e.g.*, from the service guide, the detailed notion of affected terms may influence any related obligation in that it may specify an obligation's scope. Nevertheless, general and product-specific terms are not discussed in further detail here in order to focus on remaining components of a customer agreement.

### 4.2.1 Service and Product Guides

In contrast to terminology definitions, the service publication and price guide [99] (service guide, product guide, or guide hereafter) is of direct impact to service provider and customer obligations as investigated in Section 4.3. The guide is fundamental to a customer agreement as it "*provides information about our [Verizon Business] service offerings*" and "*serves as a foundation for agreements between Verizon Business and our business customers*" [99]. It remains unclear whether the service guide represents a template for service descriptions in customer agreements or whether it is fully negotiable.

The EVPL-Metro guide [93] and EVPL-National guide [94] are listed in the category of EVPL CPA-Based, which is listed under interstate telecommunications services, Ethernet services. CPA (Converged Packet Access) facilitates layer 2 packet-access connectivity accessible by means of an Ethernet interface. EVPL-Metro and EVPL-National are EVPL CPA-Based products, whereas CPA functionality is implemented by a separate service termed Converged Ethernet Access (CEA). There is a separate CEA service guide [91] that needs to be considered for EVPL-Metro/-National analysis, since CEA is to be combined with other products, such as EVPL-Metro and EVPL-National.

The CEA guide describes CEA as a service, while EVPL-Metro and EVPL-National guides use the term product. Accordingly, EVPL-Metro and EVPL-National may be seen as products requiring CEA as a base service. The fact that CEA (as a base service) does not dispose of a distinct SLA, while EVPL-Metro and -National (in terms of a product) offer SLAs, may be seen as a hint to support this product/service interpretation. However, service and product terminology is used inconsistently throughout those different customer agreement components outlined so that, for instance, EVPL-Metro is termed product as well as service in different locations. Despite inconsistent use of terminology, it is important to note that there are (contractual) inter-dependencies between CEA and EVPL-Metro or EVPL-National, respectively. These inter-dependencies and related contractual consequences are discussed in Section 4.2.2.

The CEA service guide [91] covers a service description, a reference to general definitions [95], features and options, rates and charges, and a reference to general [96] as well as product-specific [98] terms and conditions. The service description determines CEA to pro-

vide layer 2 connectivity by means of a standard Ethernet interface from customer premises to a service provider point of presence. In non-technical terms, this means that CEA provides a service customer with an Ethernet connection from its location to the Verizon network. Four basic network configuration types (types 1 to 4 hereafter) are available. These differ mainly in whether facilities at a service customer's premises and the Ethernet connection at a Verizon point of presence are furnished by Verizon or by the customer.

### 4.2.2 Non-recurring and Recurring Charges

These differences in property show an impact on one hand on the respective contract construct to be assumed, and on the other hand on the contract obligations subsumed (*cf.* Section 4.3). Assumptions on the overall BoD contract construct are affected, since — depending on the specific infrastructure property — the existence or absence of an infrastructure contract of sale or rent (*cf.* Section 4.4) is to be expected. Contract obligations are affected as different property configurations lead to different assumptions on (secondary) provider and customer obligations, *e.g.*, with respect to infrastructure maintenance and availability guarantees. Furthermore, and most prominently, customer obligations in terms of non-recurring and recurring charges — both types prevail in CEA in addition to non-recurring administrative and service support charges — differ from one to another network configuration type selected.

Out of these four types, only type 1 or type 3 can be selected if BoD shall be facilitated. Type 1 foresees that infrastructure at a service customer's premises and at a point of presence are both furnished by the service provider. In case of type 3, infrastructure at a service customer's premises are customer-owned, while at a point of presence either property scheme may prevail. Without going into charging details here, it shall be noted that non-recurring charges for these two configuration types are within the range between 300 US$ and 3,200 US$ (lowest charges with type 1, lowest base bandwidth, and if facilities are within Verizon property), while recurring charges vary heavily: in case of type 1, recurring charges vary from a few hundred US$ to around 17,000 US$ (depending on bandwidth, network configuration type, and minimum contract period), per month and CEA service. In case of type 3, recurring costs mainly depend on bandwidth and service area. Monthly charges typically top up in the order of 20,000 US$ to 30,000 US$ for the highest bandwidth (1,000 Mbps), but they may range up to 500,000 US$ in rare cases.

According to the notion of value-added and basic communications services, CEA shows characteristics of a basic communications service. It does not provide a dynamic bandwidth feature (neither as a feature, nor as an option), but it can be configured with various base bandwidth rates up to 1,000 Mbps. Although selected bandwidths can be adapted, in principle, it is not meant to change frequently due to high charges of minimum 500 US$ per bandwidth change. Thus, taken for itself, CEA as a basic communications, non-BoD-type of service would not qualify for investigation here. It is still highly relevant to this case study, however, since CEA constitutes an integral part in the complex BoD product considered. Therefore, CEA cannot be sourced as a stand-alone service so that it is by definition a component of a larger contract construct.

The EVPL-Metro and -National guides confirm contractual interrelations with CEA explicitly as both guides state that either EVPL service "*[...] may only be provided between two*

*Converged Ethernet Access Service [...]*" [93, 94]. This implies that if a service customer wants to establish a layer 2 circuit from one of its facilities to another, that service customer needs to conclude twice a CEA service in order to connect both customer premises with the respective next Verizon point of presence. In addition, and in order to actually establish a point-to-point layer 2 circuit between the two end points including the path through the Verizon network, either a single EVPL-Metro or EVPL-National service needs to be concluded. From a contractual perspective, each EVPL service subscribed requires two CEA services subscribed. From a monetary perspective, this scheme implies that those CEA charge estimates presented need to be doubled. In addition to (double) CEA charges, any complete customer agreement will include on a per-circuit basis non-recurring and recurring charges.

For EVPL-National, non-recurring charges include administrative charges plus an installation charge (ranging from 600 US$ to 1,000 US$). Recurring charges are calculated monthly, per circuit, and according to the length of a circuit in miles. Furthermore, recurring charges depend on the bandwidth initially chosen as well as customer type. They range roughly between 2,000 US$ and 39,000 US$. For EVPL-Metro, non-recurring charges range according to the initially chosen bandwidth between 25 US$ and 100 US$, besides any administrative and support charges. Monthly recurring charges range up to around 1,200 US$ maximum, depending on the agreed minimum contract period as well as the chosen bandwidth.

In addition to those charges in relation to EVPL basic functionality, charges for the included BoD feature need to be considered. In case of EVPL-Metro, dynamic bandwidth is the only feature explicitly mentioned under the respective features and options section in the guide. In case of EVPL-National, dynamic bandwidth is one feature among others like VLAN tags. From a contractual point of view it is important to note that BoD is not an option to a customer agreement involving EVPL, but it is a feature. A feature is integral part of any EVPL-based offering encapsulating a well-defined functionality. If it were an option instead, a service customer would be able to obtain EVPL-Metro or -National without BoD. In terms of a feature, every customer agreement will include it — given that the respective technical prerequisites such as CEA of network configuration type 1 or 3 are satisfied.

### 4.2.3 Dynamic Bandwidth Feature

The BoD feature constitutes the key functionality within the considered BoD product to qualify as a value-added service under the respective definition of value-added and basic communications services. It enables a service customer "*[...] to manage Ethernet flow speeds by changing bandwidth at anytime, utilizing a web-based interface accessible through a portal on the Verizon Enterprise Center website [...]*" [93, 94]. The BoD feature fully qualifies as a value-added service as it is provided for remuneration (see details below), at a distance, by electronic means, and at the individual request of a service customer. Accordingly, EVPL-Metro and EVPL-National are characterized to cover an element of a value-added service, exactly due to the value-added BoD feature. However, whether this element of value added weighs enough to term EVPL as a value-added service is still to be discussed. The answer to this question is found in an interpretation of what mainly means in the respective definition [36] of a basic communications service. This discussion is important with respect to contractual obligations assumed. Consequently, it is found in Section 4.3.

The BoD feature allows a service customer to obtain "*[...] additional Ethernet bandwidth above the speed originally selected [...]*" [93, 94]. There are in total 48 bandwidth states to select from. For instance, if a service customer chose to source an EVPL-Metro circuit at a base bandwidth (termed baseline flow rate) of 4 Mbps, only those bandwidth states with an attributed bandwidth above 4 Mbps are available for BoD. Bandwidth may be adapted at any time, whereas only one change within a period of 24 hours is made available. Furthermore, the dynamic bandwidth feature is limited insofar as that selected bandwidth "*[...] cannot exceed the speed of the Converged Ethernet Access at either end of the circuit*" [93, 94]. This results in a scheme in which dynamically attributed bandwidth is (a) below the minimum of both involved CEA bandwidths, (b) higher than the baseline flow rate of the respective EVPL-Metro/-National service, and (c) one of these 48 standard bandwidths available within the range determined by (a) and (b).

BoD charges do not include non-recurring charges. Service customers have to cover daily recurring charges in case bandwidth changes are requested. These daily charges depend on the respective bandwidth increment. They range from 100 US$ per day for an increment of 1 Mbps up to 1,200 US$ per day for an increment of 100 Mbps. There is no information available whether increments larger than 100 Mbps are supported. In addition to EVPL baseline flow rate charges (and CEA charges), a service customer, thus, is billed "*[...] based on the highest reserved bandwidth in a calendar day [...]*" [93, 94], irrespective of whether the reserved bandwidth was used or not.

### 4.2.4 Terms and Conditions

As with respect to terms and conditions, the general terms and conditions [96] address determinations in relation to services (*e.g.*, service limitations), term and commitment, rates, cancellation, warranty and liability, and a number of miscellaneous provisions — all of which are seen in a broad manner, not specific to any product or service. Thus, general terms and definitions find application to all offerings referenced here, EVPL-Metro, EVPL-National, and CEA alike. Of special interest here are three aspects: (1) the precedence of different customer agreement components, (2) determinations on applicable law, and (3) provisions on dispute settlement.

With respect to precedence, the following order prevails: Highest priority receive those terms agreed upon under a signed contract. Second highest priority is on state-specific terms in a guide, followed by service-specific guide terms. Lowest priority see those general terms. This hierarchy outlined answers partly the question, whether guides rather constitute contract templates or a negotiation base. The precedence foresees potentially deviating terms in a signed customer agreement and the respective guides. This implies that there is a bargaining option.

Applicable law is handled in general terms in a static way as the terms are "*[...] governed by the Communications Act of 1934, as amended, to the extent applicable, and otherwise by the laws of the State of New York, without regard to its choice of law principles*" [96]. These provisions show a choice of law clause (laws of the State of New York) which is exclusive, static, and — as it is embraced by the general terms and conditions — irrespective of any service customer characteristics. Due to the precedence introduced, different applicable law provisions may be agreed upon in a customer agreement. It has to be noted, however, that the

PIL formalization conducted in Chapter 6 considers mutual dependencies, *i.e.*, characteristics of both contract parties to determine applicable law (and jurisdiction).

Similarly, provisions of dispute settlement deviate in general terms from what is foreseen in this work, in principle. These terms bind contract parties to a 30 days negotiation period in which any dispute shall be settled privately. In case that dispute cannot be settled, means of alternative dispute settlement are pursued. The term alternative means that a dispute is not brought to a state court. Instead, disputes "*[...] must be resolved by binding arbitration of a single arbitrator in accordance with the rules of the American Arbitration Association*" [96]. It shall be noted that the formalized PIL in Section 6.4 models jurisdiction-oriented provisions under explicit exclusion of alternative dispute settlement. In other terms, the model determined in Section 6.4 reflects state jurisdiction and excludes the alternative jurisdiction of arbitration.

In addition to general terms, EVPL-Metro, EVPL-National, and CEA apply product-specific terms. EVPL-Metro- and CEA-specific terms are dealt with in a single document [98]. These terms cover broad provisions in relation to basic service provider and customer obligations (*e.g.*, information duties), act in good faith (*e.g.*, reasonable efforts for maintenance and service installation), general equipment maintenance, incident management (*e.g.*, credit allowances), and change management (*e.g.*, change requests, termination). EVPL-National includes a short section of product-specific terms and conditions. These foresee that a service customer is, in principle, responsible for damage caused at customer terminal equipment if it was not due to the service provider's "*[...] negligence or willful misconduct [...]*" [94]. Moreover, a service customer accepts that the EVPL-National service may be interrupted for planned maintenance, that the service does not qualify for resale, that EVPL-National is only available at a minimum contract period of (at least) 12 months (including a charge for early termination), and that "*[...] more than 10 percent of Customer's per circuit traffic crosses state line boundaries*" [94].

### 4.2.5 SLA Provisions

In addition to service guides, features, charges, terms, and definitions as discussed previously, SLAs shall be investigated in order to complete this product study. SLA provisions are of particular interest here as they determine direct, clearly specified contractual obligations. As mentioned earlier, there is no SLA for CEA, while SLAs are available for both, EVPL-Metro and EVPL-National. EVPL-Metro and -National feature descriptions mention explicitly that there is no separate BoD-related SLA [93, 94]. Furthermore, neither the SLA for EVPL-Metro nor that for EVPL-National covers any provision in relation to dynamic bandwidth. Thus, there are no SLA guarantees for the BoD feature at all.

Both available SLAs for EVPL-Metro and EVPL-National are structured in the same way. In a first section, key terminology is explained. This covers definitions of terms like Mean Time to Repair (MTTR), service availability, service outage, and trouble ticket. Service availability and MTTR are these two major SLA dimensions foreseen when a service outage occurs. The SLAs describe a service customer's duties to report a service outage and it determines the following guarantees: For EVPL-Metro, service availability guarantee is 100% for a CEA configuration type 1 and 99.8% for a CEA configuration type 3. MTTR guarantees are 2 hours (type 1) and 4 hours (type 3), respectively. For EVPL-National, ser-

vice availability of 100% is guaranteed, and MTTR is 2 hours. In case a service outage is encountered (and correctly reported), a service customer may qualify for a service credit. For both SLAs, service credits equal to 25% of monthly recurring circuit charges are foreseen for a 1 month failure, 50% for 2 consecutive months, and 100% for 3 consecutive months. There are exclusions from SLA guarantees given, such as scheduled maintenance, outages at customer premises, and force majeure.

## 4.3 Service Provider and Customer Obligations

In pursuit of the methodology outlined, this section determines and summarizes the key set of service provider and customer obligations in relation to the BoD product case study conducted. These obligations identified here are of major interest to applicable contract types as presented in Section 4.4. There is a strong interrelation between obligations and a contract as obligations constitute legal consequences from a contract.

Before going into details of service and provider obligations, it shall be noted that any subsequent work — here with respect to obligations, in Section 4.4 with respect to BoD contract nature — falls under special reservation. The precedence introduced implies the existence of an individually negotiated customer agreement. Provisions of such an agreement might overrule those customer agreement components assessed in Section 4.2. This might lead to different obligations and a different assessment with regard to applicable contract types. Hence, due to the lack of a specifically signed agreement, any subsequent assessment bases exclusively on those generally discussed agreement components of the conducted BoD product case study.

Table 4.1 has been developed to outline the accordingly determined service provider and service customer obligations. It covers a single provider or customer obligation per row, each with indicated characteristics as follows:

**ID** — An identification key for further reference. A key consists of a three- or four-character mnemonic and a running number. An obligation is referred to subsequently by its ID.

**Obligation description** — A short textual description of what duties an obligation comprises. Some descriptions refer to locations A, B, C, or D as introduced in Figure 4.1. Locations A and D reflect customer premises, while locations B and C reflect service provider points of presence. Accordingly, EVPL and BoD relate to a (virtual) circuit between A and D, while CEA relates to the Ethernet access provided between A and B and C and D, respectively.

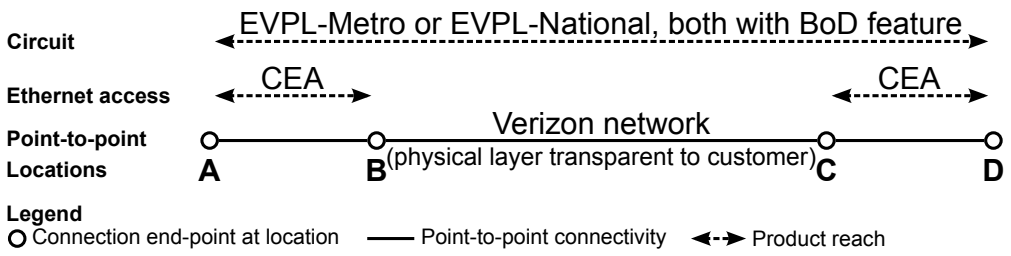


Figure 4.1: BoD Product and Location Perspectives

Table 4.1: Service Provider and Service Customer Obligations

| ID | Obligation description | Obliged party | Contractual relevance | Quality level (ID/none/n.a.) | Obligation duration |
|---|---|---|---|---|---|
| **EVPL1** | Layer 2 point-to-point connectivity (Ethernet circuit) between A and D | Service provider | Primary Obligation | SLA1 & SLA3 (EVPL-Metro, type 1; EVPL-National) SLA2 & SLA4 (EVPL-Metro, type 3) | Continuing obligation within minimum contract period |
| **EVPL2** | Layer 2 Ethernet flow rate between A and D (EVPL baseline flow rate) | | Secondary Obligation | None | |
| **CEA1** | Converged Ethernet access between A and B | | Primary Obligation | Implicitly: SLA1 & SLA3 (EVPL-Metro, type 1; EVPL-National) SLA2 & SLA4 (EVPL-Metro, type 3) | |
| **CEA2** | Converged Ethernet access between C and D | | | | |
| **CEA3** | CEA full bandwidth between A and B | | Secondary Obligation | None | |
| **CEA4** | CEA full bandwidth between D and C | | | | |
| **BOD1** | BoD increment between A and D; total bandwidth below/equal MIN(CEA3, CEA4), above EVPL2 | | | | Continuing obligation within reservation period |
| **PAY1** | Remuneration for total of non-recurring and recurring charges covering EVPL1, EVPL2, CEA1-4, BoD1 | Service Customer | Primary Obligation | | Continuing obligation within minimum contract period |
| **EQU1** | Furnish equipment at A and B (type 1, potentially type 3) | Service provider | Secondary Obligation | | |
| **EQU2** | Furnish equipment at C and D (type 1, potentially type 3) | | | | |
| **EQU3** | Furnish equipment at A (type 3) | Service Customer | | | |
| **EQU4** | Furnish equipment at D (type 3) | | | | |
| **EQU5** | Furnish equipment at B (type 3) | Service provider | | | |
| **EQU6** | Furnish equipment at C (type 3) | | | | |
| **SLA1** | 100% service availability of EVPL1 and, implicitly, CEA1 and CEA2 | | | n.a. | |
| **SLA2** | 99.8% service availability of EVPL1 and, implicitly, CEA1 and CEA2 | | | | |
| **SLA3** | 2 hours MTTR for EVPL1 and, implicitly, CEA1 and CEA2 | | | | |
| **SLA4** | 4 hours MTTR for EVPL1 and, implicitly, CEA1 and CEA2 | | | | |
| **CRE1** | 25% refund of recurring charges related to EVPL1, EVPL2 | | | SLA1-4 (1 month failure) | |
| **CRE2** | 50% refund of recurring charges related to EVPL1, EVPL2 | | | SLA1-4 (failure in 2 consecutive months) | |
| **CRE3** | 100% refund of recurring charges related to EVPL1, EVPL2 | | | SLA1-4 (failure in 3 consecutive months) | |
| **GEN1** | General provider obligations (*e.g.*, act in good faith, reasonable efforts, maintenance, incident/change management) | | | None | |
| **GEN2** | General customer obligations (*e.g.*, reasonable efforts and cooperation, neglect of resale, information duties, more than 10% cross-state traffic in case of EVPL-National) | Service Customer | | | |

**Obliged party** — A reference to either a service provider or a service customer in terms of the party bound by an obligation in consideration.

**Contractual relevance** — Determines an obligation in question as either a primary obligation or a secondary obligation. This qualification is of key importance to the discus-

sion conducted in Section 4.4. An obligation is termed primary, if non-compliance with it renders a contract into a state of non-performance. Consequently, secondary obligations are those obligations that keep a contract binding despite such a secondary obligation might have been broken (see, *e.g.*, [18] Art. 2). Primary obligations are, thus, related to the *essentialia negotii* of a contract.

**Quality level** — Indicates any attributed quality level guarantee. In case there is a guarantee, *i.e.*, there is an SLA, that SLA is referenced by its ID. In case the considered obligation covers an SLA guarantee, "n.a." is mentioned.

**Obligation duration** — An obligation can be either a one time or a continuing obligation. In the latter case the applicable time frame in which an obligation remains valid is mentioned.

### 4.3.1 Service Customer Obligations

These obligations identified and documented in Table 4.1 cover dimensions of services (EVPL, CEA, and BoD), compensation for these services, infrastructure at all locations (*cf.* Figure 4.1), SLA guarantees and related service credits, and those general (secondary) obligations originating from general terms and conditions. Out of these 23 obligations listed, 4 are attributed to a service customer. These comprise obligations PAY1, EQU3, EQU4, and GEN2.

This small number is mainly due to the fact that PAY1 acts as a container to reflect total compensation for all single service-related provider obligations listed. Such subsumption reflects the right of a service provider to cancel service provisioning if "*any sum owed by the Customer has not been paid [...]*" [96] within the respective period allowed for payment — emphasis being on any sum outstanding. Hence, the only primary obligation relevant to a service customer is to pay the sum of non-recurring and recurring charges in time. In Section 4.4, however, a slightly different approach is adopted when investigating those different customer payment duties in further detail. Compensation obligations are taken into account there as an indicator to compare the contractual impact of EVPL and CEA services and that of the BoD feature according to their respective charge weights. This approach is adopted in order to estimate the respectively applicable party will.

### 4.3.2 Service Provider Obligations

For a service provider, those obligations determined are more diverse, since different obligations may or may not qualify as a primary obligation, and they may or may not see SLA guarantees attributed. Primary service provider obligations are EVPL1, CEA1, and CEA2, while all other obligations are characterized as secondary obligations. EVPL1 is qualified as primary obligation for reasons that it is in relation to the complete virtual circuit between A and D and that there are related SLA guarantees available. EVPL2, in contrast, sees no guarantee at all. The same SLA guarantee-driven argument is adopted to term CEA3, CEA4, and BOD1 secondary obligations. Even though BOD1 originates from an inalienable feature from both, EVPL-Metro and EVPL-National, and despite one may argue at least for EVPL-Metro that BoD is even the single available feature, the dynamic bandwidth functionality is

not guaranteed in any way. Thus, non-compliance does not result in any service credit, nor does it result in non-performance of a customer agreement.

CEA1 and CEA2 constitute primary service provider obligations not because of their location scope covering distances between A and B and C and D, respectively, but these obligations are primary obligations since they are (implicitly) covered by SLA1-4, depending on the respective EVPL and network configuration type chosen. SLA1-4 are bound to EVPL-Metro and EVPL-National. Nevertheless, the respective availability and MTTR guarantees provided for EVPL have implications to availability and MTTR guarantees on CEA level. In case CEA on distances A-B or C-D is not available, EVPL is not available either. CEA service outage, thus, qualifies for EVPL SLA application as well.

Finally, it shall be noted that all obligations identified are continuing obligations. This is due to the fact that a customer agreement defines a minimum commitment period. Within this minimum contract term, service provider and service customer obligations have to be kept. The exception to this rule is found in BOD1. As a feature that is free of non-recurring charges — meaning it results in charges and bandwidth provisioning duties only if actively used — the respective obligations endure only during the time a bandwidth increment is reserved. BOD1, thus, constitutes a contingent commitment.

## 4.4 The Nature of BoD Contracts

Due to the fact that the specific characteristic performance (and with that the applicable contract type) of an electronic service is not fully understood to date, the according legal consequences are still unclear. See, for instance, [40] for an exhaustive discussion of applicability of contract of order law to a continuing obligation. This missing understanding and its lacking of legal consequences implies that there is neither a standard contract for an electronic service offering such as a BoD product available, nor is there a court decision or a common agreement among jurists as of today. Accordingly, a BoD contract characterization is of theoretic and controversial nature. In the light of lacking precedent, however, it is seen as the only way to determine the very basic legal contractual frame for BoD contracts — which is essential to achieve this work's overall objective of an automated, legally compliant contract formation. Given these complex circumstances, the characterization performed here is conducted as a simulated characterization in consideration of an exemplary European civil code of obligations, namely the Swiss code of obligations [18]. This allows to draw specific conclusions which should, in general, be directly transferable to comparable European civil law systems.

### 4.4.1 Swiss Nominate Contract Types

The Swiss[1] code of obligations defines on one hand a number of well-known, specified contract types, termed nominate contracts (as these contract types are "nameable"), while at the other hand it subsumes contracts of other, unspecified types under the category of so-called

[1]The respective list of nominate contracts may differ from jurisdiction to jurisdiction, and it might be that such list is inexistent in some jurisdictions. The list of nominate contracts as determined by the Swiss Code of Obligations is seen as a reference case for nominate contract types from a (continental) European angle.

innominate contracts (as these do not dispose of an identifying name nor is their nature specified within the code). Under the basic principle of contractual freedom ([18], Art. 19), the need for innominate contracts becomes obvious, since contract parties are not bound to adhere to a pre-defined and — in the short and medium term — static set of contracts, but they are allowed to form contracts according to their respective needs. Innominate contract types may be codified, *i.e.*, rendered into nominate regulated contracts, if they gain substantial weight in contracting.

The code of obligations is structured into 5 main parts. Part 1 ([18], Art. 1-183) contains general provisions elaborating on how obligations — such as those determined in Section 4.3 — emerge, what their effects are, how they cease, and how they are transferred to others. Of particular relevance to this work is [18], Art. 18 which determines how a contract characterization shall be conducted. Part 2 ([18], Art. 184-551) presents in full detail those contract types that were codified, thus, became nominate contracts.

Different contract types cause different legal consequences, most prominently they cause type-specific obligations to be fulfilled by contract parties (*e.g.*, with respect to performance, compensation, or warranty), but they also cause other legal consequences, such as type-specific rights (*e.g.*, right of withdrawal). Table 2.2 gives an overview of nominate contracts as determined by the Swiss code of obligations. For each contract type, a short description of the applicable legal transaction is listed and the respective articles in the code are referenced. Table 2.2 covers those 18 nominate contract types that are directly reflected by the code. There are two additional contract types — contracts of package holiday and of consumer credit — sometimes subsumed under the term of nominate contracts, since these contract types are codified within the frame of separate Swiss federal laws. Only the 18 nominate contract types in the code as outlined in Table 2.2 are further assessed for a qualitative preselection and subsequent detailed analysis, since contracts of package holiday and contracts of consumer credit are obviously out of scope here.

### 4.4.2 Contract Qualification Procedure

In order to conduct a contract qualification using the respectively accurate criteria (here adopting a Swiss legal perspective), provisions of [18], Art. 18 need to be considered. This article denominates the key criteria under which a contract qualification shall be conducted: Highest priority in characterizing has the *will* under which contract parties concluded a contract, whereas chosen terminology is of secondary relevance. This means that even in case a contract was termed erroneously or intentionally in such a form that the accordingly attributable contract type would not conform to the contract type to be attributed according to the (assumed) contract parties' *will*, that contract type in accordance with the (assumed) contract parties' *will* gains preference.

A typical full-fledged contract characterization as to be expected by a court in case of a dispute would adopt an approach called the claims method (see, *e.g.*, [49]). This method funds on (ancient) Roman law and it reflects on answering the question of who is entitled to claim what from whom and on what basis. A claim constitutes an (enforceable) right of doing something, tolerating something, or refraining from doing something. The claims method embraces three steps. Firstly, the respective *will* of involved parties is determined and documented. Secondly, the applicable legal ground based on what parties seek to substantiate

what they want is identified. Thirdly, facts in relation to the current matter are analyzed on whether they justify the respective prerequisites of a claim raised. However, within the scope of this work — which is not specific to a given dispute and contract — only the sub-aspect of determining the respective contract type applicable to a BoD contract is conducted.

Accordingly, those nominate contracts presented in Table 2.2 are investigated whether they may apply to the case of a BoD contract. This investigation takes those insights gained from the BoD product study in Section 4.2 into account, in particular it considers the obligations determined in Section 4.3, while it puts an emphasis on a contract party's *will* assumed.

### 4.4.3 Mapping of Obligations to Nominate Contract Types

Before going into a detailed discussion of applicable contract types, out of those nominate contract types covered by Table 2.2, those types are pre-selected to which any of the identified obligations shows a relation *ex ante*. Such relation is given in case an obligation shows characteristics of a legal transaction originating from a nominate contract type. The obligation PAY1, the primary service customer obligation, is not explicitly included in this pre-selection as PAY1 is the compensation-related counterpart of all provider obligations offered for money. Thus, where a legal transaction involving remuneration is envisaged, PAY1 is involved, but it is not named explicitly within the pre-selection.

Table 4.2: Mapping of Obligations to Nominate Contract Types According to Legal Transaction

| Obligation(s) | Nominate contract characteristics | Possible legal transaction |
|---|---|---|
| **EQU3, EQU4** | Sale | Ownership transfer of customer premises equipment from service provider to service customer in exchange for a purchase price. |
| **EQU1-6** | Rent | Transfer for use of customer premises and/or point of presence equipment from service provider to service customer for a rent. |
| | Leasehold | Transfer for use of customer premises and/or point of presence equipment from service provider to service customer including service customer right to commercially exploit infrastructure (not including any resale). |
| | Borrowing | Transfer for use of customer premises and/or point of presence equipment (including obligation to return after use) from service provider to service customer free of charge. |
| **EVPL1, CEA1[a], CEA2[a], SLA1-4, CRE1-3** | Work and labor | Production of a work (primary result owed: EVPL1 and, implicitly, CEA1, CEA2; guaranteed by SLA1-4; secondary result owed in case SLA guarantees broken: CRE1-3) in exchange for compensation. |
| **EVPL2, CEA3, CEA4, BOD1, GEN1, GEN2** | Order | Procurement of delegated services (service provisioning without owed result) in exchange for compensation. |

[a] Implicitly, meaning *de facto*

Table 4.2 documents the accordingly pre-selected nominate contract types. These are determined by the respective mapping of obligations to a suitable contract type. Each mapping lists a possible legal transaction assumed. Table 4.2 starts with equipment-related obligations. If customer premises equipment is bought by a service customer from a service

provider, the applicable legal transaction shows main characteristics of a contract of sale. If equipment is made available by a service provider for use by a service customer, the applicable legal transaction shows characteristics of either a contract of rent (use in exchange for a rental fee), a contract of leasehold (as in rent, with the right to commercially exploit the involved equipment), or a contract of borrowing (if equipment use is free of charge). As none of the investigated customer agreement components investigated in Section 4.2 contains distinct information on equipment transfer either scheme may be assumed.

The second part in Table 4.2 deals with an obligation/contract type mapping in relation to service provisioning obligations. Depending on whether a service provider is bound to produce and deliver an actual result to a service customer or not, the applicable legal transaction shows main characteristics of either a contract of work and labor or a contract of order. Any result owed is in close relation to SLA guarantees issued, in particular if such an SLA promises a (near) perfect work. Such a promised result prevails in case of the SLA-guaranteed EVPL2 and the (implicitly guaranteed) CEA1 and CEA2 obligations. Obligations CRE1-3 comprise promised results of secondary order. These results are promised if SLA guarantees are not held within a specified period of time.

In summary, nominate contract types of sale, rent, leasehold, borrowing, work and labor, and order are pre-selected for further discussion. In contrast, a number of contract types is excluded from detailed investigation *ex ante*. For the reason that the respective legal transaction is out of scope here, the majority of remaining contract types are excluded. These cover notably contracts of employment, publishing, agency of necessity, commission, affreightment, procuration, power of attorney, allocation, deposit, surety/bail, play and bet, annuity, prebend, and non-trading partnership. A contract of gift is excluded as no donations are assumed to take place within the scope of a commercial BoD contract. Finally, a contract of loan is excluded, since it is assumed that the exact same good (as opposed to the same kind of a lent good) transferred for use needs to be given back after usage.

### 4.4.4 Contract Taxonomy

At this stage of work a potentially conflicting situation becomes apparent. On one hand, multiple contract types are found to qualify potentially for subsumption in a BoD contract. These contract types are in relation to single obligations which, in turn, are identified based on an existing BoD product case (*cf.* Section 4.2). On the other hand, identified obligations do not reflect single contracts in accordance with the case studied. For instance, EVPL1 and EVPL2 see differing characteristics from an obligations perspective (*e.g.*, with respect to SLA guarantees), whereas both obligations are integral part of a single EVPL subscription. In other terms, EVPL1 and EVPL2 cannot be obtained separately by a service customer. From a contractual point of view, EVPL1 and EVPL2 are bound by a single contract, even though the actual obligations see characteristics of different nominate contracts as outlined in Table 4.2.

The (supposed) contract of an EVPL-Metro or EVPL-National subscription, thus, integrates contract elements of a contract of work and labor as well as of a contract of order. The same controversy of a contract (or contracts) covering elements of multiple nominate contract types applies to the contract construct (the customer agreement) presented in the BoD product case study. Therefore, the suitable nature of a BoD contract is only determined

if its place within a relevant contract taxonomy, such as the one documented in Figure 4.2 is found.

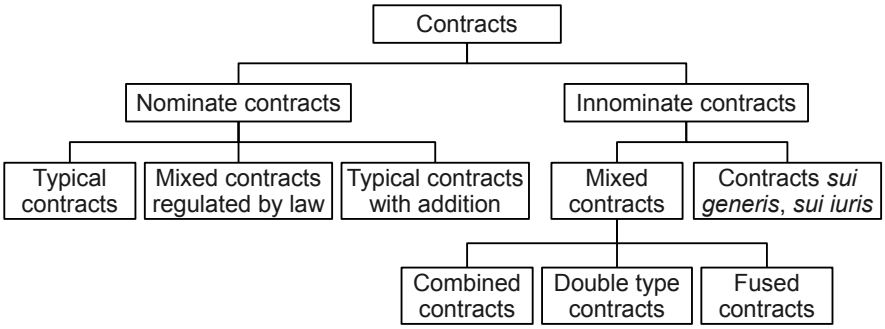


Figure 4.2: Contract Taxonomy [49, 78]

The taxonomy as of [49, 78] groups contracts into nominate and innominate contracts as introduced previously. So far, determined obligations are attributed by means of a qualitative pre-selection to typical contracts within the category of nominate contracts. As argued, however, these obligations are not covered by directly attributed, separate contracts — when thinking in terms of product offerings such as EVPL and CEA, which may each be covered by a separate contract, possibly embraced by a frame contract (termed customer agreement in Section 4.2). Within this line of arguments, a different category of Figure 4.2 than the one of typical contracts has to be assumed for the BoD product case's customer agreement and its contractual components.

In order to address this issue, an understanding of what contractual claims a service provider and a service customer may state on the basis of the customer agreement needs to be obtained (*cf.* claims method as introduced previously). The accordingly assumed party *will* is essential here due to the lack of a complete, signed customer agreement. The respective outcome of this procedure is determined by a (supposed) contract construct reflected by a customer agreement. This contract construct is then used to find a customer agreement's suitable place in Figure 4.2.

### 4.4.5 Supposed Contract Party Will

As with respect to a service customer's supposed *will*, the basic assumption is adopted that a service customer primarily wants to connect two of its premises by means of a circuit. Issues of equipment and point of presence access might be agreed and are willingly contracted by a service customer, but these aspects are expected to be of secondary relevance to a customer. An assessment of a service customer's *will* with respect to the BoD feature, however, is more controversial. In absence of a service customer, it can only be argued about. [92] might be of help in terms of an indicator to indirectly conclude a service customer's supposed *will* with respect to dynamic bandwidth. This indicator is about how a service provider promotes EVPL to service customers. [92] promotes scalable bandwidth prominently as the second listed characteristic and it recommends EVPL to customers that need "*high-speed, scalable, all fiber optic, point-to-point connectivity*". This promotion material is taken as a clue to express a service customer's *will* indirectly by means of what a service provider thinks a service customer might want from EVPL. Accordingly, a service customer may be concluded

to perceive EVPL as a value-added service, meaning that a customer may draw no clear line between a (basic) circuit service and a (value-added) dynamic bandwidth feature.

For a service provider, a similar *will* is assumed. In the end, a customer agreement is concluded by a service provider to offer a point-to-point circuit — this is the essence not only of what a service customer wants, but also of what a service provider is willing to offer. Thus, customer and provider *wills* are not expected to differ in principle. This viewpoint is in-line with the argumentation for having a single customer obligation (PAY1). A service provider may stop overall service provisioning in case of outstanding payments, instead of disrupting a single service. In the same way it was argued that all a service customer is interested in is a working circuit, all a service provider wants to see is a payment for the sum of all charges — irrespective from what service and from what contract these single charges originate. Nevertheless, a comparison of relative charge levels covering monthly recurring costs of CEA, EVPL, and BoD might help as an indicator to reveal a more differentiated view at a supposed provider *will*. Of course, actual charges depend on several parameters such as minimum contract period, service area, and configuration types. Still, a BoD increment reservation for half a month and 100 Mbps is found to be around 15 times more expensive than the recurring costs of EVPL-Metro for a month. Furthermore, monthly charges of an average CEA type 3 service are about as high as monthly charges for an average EVPL-National service. Since each EVPL service requires two CEA services, however, CEA charges are twice as high as those of EVPL. These two example charge schemes mentioned indicate that — albeit customer and provider *wills* are assumed to be comparable in principle — a specific customer agreement might lead to potentially conflicting customer and provider *wills*. This potential prevails in situations where charge weights do not reflect party *wills* assumed.

### 4.4.6 Supposed Contract Party Claims

This discussion of party *will* is not to be confused with the respective discussion of potential claims. The first investigates what a party assumes from a contract, the latter determines what a party can actually claim from it. From those customer agreement components studied in Section 4.2, what a service customer can realistically claim is in direct relation to those primary service provider obligations listed in Table 4.1. This includes EVPL1, CEA1, and CEA2 obligations. A service customer can claim compliance with these obligations as these are primary obligations with SLA guarantees attached. As a consequence, a service customer can claim compliance with the related SLAs (obligations SLA1-4) and service credits (CRE1-3) — otherwise, SLA provisions would not constitute guarantees in the first place. Expressed in contractual terms, those obligations qualified to show characteristics of a contract of work and labor (*cf.* Table 4.2) constitute the applicable range of contractual claims possible for a service customer.

For a service provider, the accordingly possible claim is reflected by obligation PAY1, the primary obligation of a service customer. A service provider's compliance with the remaining (secondary) service-driven obligations cannot be claimed, due to the fact that the service provider does not issue any sort of guaranteed promise. A service provider, thus, is only bound to put reasonable effort in the procurement of these services.

### 4.4.7 Applicable Contract Construct

Successive to those discussions conducted on supposed party *will* and contractual claims, the applicable contract construct needs to be determined. In the product case study conducted, a service customer interested in using a BoD-enabled layer 2 circuit was found to sign a customer agreement which — besides terms and conditions as well as definitions — embraces a single subscription of either EVPL-Metro or EVPL-National, plus two subscriptions of CEA in either type 1 or 3. The customer agreement embraces dynamic bandwidth without a separate subscription as it is automatically included in either EVPL variant. Depending on the respective CEA configuration type chosen, there are varying equipment property schemes in locations A-D (*cf.* Figure 4.1). According to the applicable contract component precedence, a customer agreement may contain provisions deviating from standard provisions as it may be individually negotiated.

In summary, a customer agreement must include — in terms of a minimum set — a contractual element for the circuit functionality with dynamic bandwidth (EVPL service and BoD feature) as well as a contractual element for the two point of presence accesses (CEA services). In terms of a larger set assumed, a customer agreement may contain, in addition to the above mentioned, several BoD-enabled circuit contract elements (either one per circuit or several circuits bundled), several access contract elements (again, either as single elements or bundled, but always for twice as many CEA services than the number of circuits), plus one or several equipment-related contract elements.

In order to combine the assumed party *will*, contractual claims, and contract constructs as discussed, the contract nature of a customer agreement — termed BoD contract hereafter — is qualified as follows: A BoD contract is a frame contract to embrace multiple elements. Highest priority according to supposed mutual party *will* obtains the provisioning for money of a layer 2 circuit between customer premises with partly guaranteed, partly non-guaranteed characteristics. Guaranteed are availability and MTTR levels in relation to the full circuit distance. Non-guaranteed are any bandwidth-related provisions, dynamic as well as static ones. Dynamic bandwidth allocation is perceived by a customer as a key aspect, whereas both parties accept its best effort character, as it is clearly marked as a non-guaranteed feature, despite being prominently promoted in the product description. The BoD contract, thus, is characterized as a contract in relation to a value-added electronic service dominating the complete contract construct, namely to that of a BoD-enabled layer 2 circuit. The BoD contract embraces further, dependent elements which all are of second priority according to supposed mutual party *will*. These comprise terms and conditions and optionally equipment supply.

### 4.4.8 BoD Contract Qualification

As a further step in this simulated contract qualification, the determined BoD contract needs to be placed accordingly in the taxonomy [49, 78] of Figure 4.2, leading in a final step to the attribution of applicable contract types. Table 4.3 outlines the respective reasoning for the taxonomy of contract types in question as discussed in detail subsequently.

A BoD contract was found to not fit within the category of typical nominate contracts. None of these nominate contract types presented in Table 2.2 match the complex construct of a BoD contract directly. The same holds for the category of mixed contracts regulated by law as there is no regulated contract integrating two nominate contracts in such a way it would

Table 4.3: BoD Contract Qualification Summary

| | | | Applicable/ Not applicable | Reasoning |
|---|---|---|---|---|
| Nominate Contracts | Typical contracts | | Not applicable | None of the nominate contract types out of the Swiss Code of Obligations matches the complex contract construct of a BoD contract appropriately. |
| | Mixed contracts regulated by law | | Not applicable | No regulated contract is identified to integrate two nominate contracts in such a way it would fit the nature of a BoD contract. |
| | Typical contracts with addition | | Not applicable | A BoD contract might be qualified as a contract of work and labor, in principle, with a BoD addition. By supposed party will, however, BoD is perceived as a major aspect (at least to a service customer) in the overall contract. |
| Innominate Contracts | Mixed contracts | Combined contracts | Not applicable | Primary obligations of EVPL1, CEA1, and CEA2 are not attributed to different nominate contract types. |
| | | Double type contracts | Not applicable | Exchanged primary obligations are neither of different contract nature nor of different contractual objects. |
| | | Fused Contracts | Not applicable | A single type of compensation (full monetary compensation) is envisaged for all primary obligations in a BoD contract. |
| | Contracts *sui generis*, *sui iuris* | | Applicable | A BoD contract is found to feature an inner single entity, content-wise, while neither its main contractual element can be subsumed under a nominate contract nor is such a contract regulated by a law. |

fit the nature of a BoD contract. Such a mixed contract would probably have to cover the nominate contracts of work and labor and of order. In contrast, the third nominate contract category of typical contracts with addition determines a potential fit. Such contracts are not perceived as innominate contracts, as they deviate from a nominate contract in a minor aspect only. A BoD contract might be qualified as a contract of work and labor, in principle, whereas provisions of BoD, static bandwidth, and optionally of equipment supply would qualify as minor deviating aspects. This qualification, however, can hardly sustain any argument with respect to supposed party *will*: In particular BoD is, albeit not guaranteed, not perceived as a minor aspect in the overall contract. In particular, for a service customer, dynamic bandwidth functionality is assumed to be of key importance — an interpretation substantiated by the respective service provider marketing activities. This leads to the conclusion that a BoD contract is rather considered an innominate than a nominate contract.

Consequently, the question needs to be addressed whether a BoD contract is qualified as either a mixed contract or a contract of its own kind (contract *sui generis*). The latter category applies in case a contract is found to feature an inner single entity, content-wise, while neither its main contractual element can be subsumed under a nominate contract nor is such a contract regulated by a law. In contrast, mixed contracts feature elements known from nominate contracts with respect to primary obligations involved. Within the category of mixed contracts, the respective sub-categories of combined, double type, and fused contracts need to be considered.

[49] defines combined contracts as contracts in which at least one party offers multiple primary obligations that each are to be subsumed under a different nominate contract type. The respective counter obligation is usually uniform in nature, typically consisting in monetary compensation. Such a contract comes close to the understanding of a BoD contract, in particular with respect to multiple primary obligations in exchange for uniform compensation. However, the identified primary obligations EVPL1, CEA1, and CEA2 are not attributed to different nominate contract types (*cf.* Table 4.2). In double type contracts, contract parties exchange primary obligations which fall either each under a different nominate contract or they are of the same contract type, but see a different contractual object. [49] mentions examples of reciprocal business transactions such as borrowing of CDs in exchange for borrowing of books and rent of an apartment in combination with housekeeper

work. Double type contracts are not attributed to BoD contracts as exchanged primary obligations are neither of different contract nature nor of different contractual objects. This leads to an application of either a fused contract or a contract *sui generis*. In fused contracts, a primary obligation is attributed to different contract types with respect to different compensation means in relation to that obligation. [49] mentions the example of a sale below market value which, in terms of compensation, integrates aspects of sale and gift. Fused contracts are not applicable to BoD contracts as full monetary compensation is envisaged for all primary obligations.

Therefore, a BoD contract is qualified as follows: BoD contracts are close to the respective nature of typical contracts with addition (nominate contract category) as well as of combined contracts (innominate contract category). Despite being close in nature, BoD contracts cannot be subsumed under either type mentioned. Hence, a BoD contract is qualified as a contract *sui generis* which is an innominate contract. As such, BoD contracts do not predominantly combine elements of nominate contract types, irrespective of the fact that identified obligations were attributed in a qualitative pre-selection to nominate contract types (*cf.* Table 4.2).

## 4.5 Case Study Summary

From the case study and contract qualification performed in this chapter the set of major results is obtained as follows. The first result of key importance is found in the comprehensive list of service and provider obligations in relation to a BoD contract as documented in full detail in Table 4.1. This list includes a relative assessment of determined contract obligations as either primary or secondary obligation. This valuation is highly relevant to characterize a BoD contract.

A service provider is accordingly bound to provide layer 2 point-to-point connectivity (an Ethernet circuit) between two customer premises (obligation EVPL1 in Table 4.1). Furthermore, the service provider is obliged to provide converged Ethernet access between customer premises and a provider point of presence (obligations CEA1 and CEA2 in Table 4.1). On the other hand, a service customer is bound by a single composite obligation, namely to pay the respective total of non-recurring and recurring charges (obligation PAY1 in Table 4.1). It is important to note that the respective provider obligations to reserve and attribute bandwidth in both, static and dynamic manner, are assessed as secondary obligations for the lack of any SLA guarantees attributed. This is of particular importance here, since BoD contracts are studied.

In the specific case study investigated, thus, dynamic bandwidth provisioning constitutes an important product aspect as it is integral part of any layer 2 circuit, but BoD is offered as a feature only, not as a guaranteed service of its own. Of further note is the insight that all identified obligations are continuing obligations. This is of particular relevance to the approximation of obligation to nominate contract types as carried out in Table 4.2. Even though the characteristic of a continuing obligation is not reflected by any of those nominate contract types considered (*cf.* Table 2.2), the nominate contract types of sale, rent, leasehold, borrowing, work and labor, and order have been pre-selected for further discussion.

A comprehensive discussion of a BoD contract's nature and, with that, the outcome of a simulated, elaborate BoD contract qualification as performed in Section 4.4, constitutes

the second major result of this work. In order to qualify a BoD contract, an in-depth understanding of what contractual claims a service provider and a service customer may state on the basis of a customer agreement was found to be essential. Contractual claims were determined in accordance with the claims method. The claims method reflects on answering the question of who is entitled to claim what from whom and on what basis. A claim constitutes an (enforceable) right of doing something, tolerating something, or refraining from doing something. In addition to claims, the accordingly assumed party will was perceived to constitute crucial input to a contract qualification due to the lack of a complete, signed customer agreement. The respective outcome of this procedure has been determined by a (supposed) contract construct reflected by a customer agreement. This contract construct was then used to find a customer agreement's suitable place in the contract taxonomy reflected by Figure 4.2.

Accordingly, a BoD contract construct (in relation to the product study investigated) has been determined as a frame contract that embraces multiple elements. Highest priority according to supposed mutual party will obtains the provisioning for money of a layer 2 circuit between customer premises with partly guaranteed, partly non-guaranteed characteristics. Guaranteed are availability and MTTR levels in relation to the full circuit distance. Non-guaranteed are any bandwidth-related provisions, dynamic as well as static ones. Dynamic bandwidth allocation is supposed to be perceived by a customer as a key aspect, whereas both parties accept its best effort character. A BoD contract, thus, has been characterized as a contract in relation to a value-added electronic service dominating the complete contract construct, namely to that of a BoD-enabled layer 2 circuit. A BoD contract embraces further, dependent elements which all are of second priority according to supposed mutual party will. These comprise terms and conditions and optionally equipment supply.

In conclusion, a BoD contract has been generally qualified as follows (*cf.* Figure 4.2 for contract category names mentioned): BoD contracts are close to the respective nature of typical contracts with addition (a nominate contract category) as well as of combined contracts (an innominate contract category). Despite being close in nature, BoD contracts cannot be subsumed under either type mentioned. Hence, a BoD contract is qualified as a contract *sui generis* which is an innominate contract. As such, BoD contracts do not predominantly combine elements of nominate contract types, irrespective of the fact that identified obligations were attributed in a qualitative pre-selection to nominate contract types (*cf.* Table 4.2). A contract *sui generis* — a contract of its own kind — applies in case a contract is found to feature an inner single entity, content-wise, while neither its main contractual element can be subsumed under a nominate contract nor is such a contract regulated by a specific law.

The case study was performed in great detail for a specific instantiation of a commercial service offering. Beyond the BoD case-specific insight gained, this case study helps determine the respective generalized notion of international service contracts. This embraces the applicable understanding of contractual obligations, the respective service guarantees, the contract construct, and the contract qualification in a general — thus, not a case-driven — manner. This contractual notion as determined throughout the case study constitutes a cornerstone in addressing the identified gap of a missing service and contract understanding. It is fundamental to all further work in this thesis, since they rely on a common underlying contractual notion. The contractual notion developed from the case study impacts most directly the information model with respect to the embraced information concepts and information

artifacts. For instance, the information model foresees the support of complex service contract constructs, the concept of service guarantees, and — in more general terms — it is able to cope with innominate contracts, since international service contracts are concluded to qualify typically as contracts of their own kind.

# Chapter 5

# Information Model

This chapter addresses the development of an information model that covers service and contract dimensions equally. These dimensions are driven by the respective identified gap of concepts and information artifacts lacking in relation to the type of service and contract assumed here. In this light, the information model profits directly from the deep going contractual understanding obtained by the case study conducted. Case study input is of particular importance to a number of basic assumptions taken. These assumptions provide the fundamental notion of a contract relation between a service provider and a service customer.

The accordingly developed information model embraces the required information objects that facilitate, content-wise, an automated determination of recommended jurisdiction(s) and/or applicable law(s) in DeRISC, the decision support system envisioned. With respect to information objects, the information model differentiates two abstraction layers: the basic concept model showing general information classes and high-level dependencies, and the artifact model breaking down class definitions to their attributes level and, thus, enabling data modeling and model-driven implementation. The concept model is an adaptation of an existing comprehensive SLM information model [77] which was largely extended to feature dimensions of contract management. The artifact model embraces connecting factors — these constitute the actual information artifacts — and relates connecting factors to information concepts.

The information model lays down a common frame for modeling a PIL and for implementing a modeled PIL. For modeling purposes, the information model provides the set of relevant service- and contract-driven information concepts. Each modeled PIL will enrich the information model by means of specific information artifacts reflecting connecting factors. These information artifacts stand in relation to a given set of information concepts, such as to the concept of a contract party. Modeled information artifacts denote the set of facts to be taken into consideration in the implementation for a reasoning about recommendations.

## 5.1 Basic Assumptions and Relationships

Figure 5.1 shows the initial starting point for the information model with respect to the applicable business (and contractual) relationship considered. This relationship covers a service provider and a service customer, whereas it has to be noted that a service customer may or may not be the same entity as the service user. Within the scope of this work, thus,

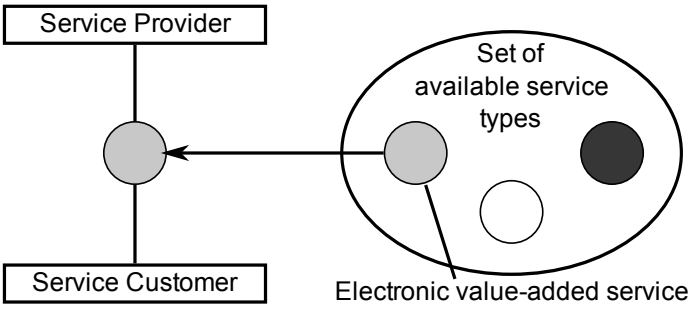


Figure 5.1: Customer/provider Relationship

a differentiation between that party that uses and that pays for a service is made. Figure 5.1 also includes the object of such a customer/provider business relationship, namely the contracted service to be provided and consumed, respectively. As learned from the case study, a service provider and a service customer might agree on a provisioning of not only a single service, but a number of services for which, in turn, either a single contract construct (multiple services bundled under a frame contract) or a separate contract for each service provided is concluded. These service provisioning and contracting options have been taken into consideration accordingly in the concept model.

According to ITIL [76], a service can be regarded as a means of delivering value to customers by facilitating outcomes customers want to achieve without the ownership of specific costs and risks. As a specialization of this definition, an electronic service can be defined as a service that can be realized exclusively by means of electronic systems and information technology equipment as well as through aggregation and interconnection of such systems. In the context of this thesis, electronic services are focused exclusively.

Figure 5.2 develops the previously introduced customer/provider business relationship further by including potential internal or external suppliers — parties which are possibly not known to a service customer — and potential service users as well as further service customers (when re-selling a service) — parties possibly not known to a service provider.

It is important to note that this thesis focuses on the primary business relationship between (exactly) one service customer and (exactly) one service provider and, thus, abstracts away potential further business relations within the scope of a service provider or a service customer, respectively. This implies a bilateral contractual agreement for an electronic service as negotiated between the respectively involved service provider and service customer only. Such a contractual agreement may find a technically measurable representation in an associated service level agreement (SLA). The information model is concerned with those concepts and information artifacts that allow the legally compliant formation of an international service contract. In particular, concepts and artifacts are focused that facilitate an automated determination of jurisdiction and applicable law recommendations.

## 5.2 Concept Model

In accordance with those basic assumptions taken, the key set of goals relevant to the concept model developed has been identified as follows:

- The concept model has to specify the information to be processed and maintained in the context of SLM and its activities.
- It has to determine information object definitions that can be used to bundle all relevant information in a clear set of object classes (each class representing a concept).
- It has to state specific informational requirements with respect to the identified information objects.
- It has to determine interrelations, dependencies and multiplicities between the identified information objects.

Figure 5.3 shows major concepts relevant to the existing ITSM model as documented in full detail in [77]. This model serves as a starting point to determine appropriate and necessary adaptations. The existing model's adopted focus on SLM-driven concepts requires extension towards an angle covering both, service management and contracting concepts. Contracting issues and provisioning/management aspects of contracted services are both of interest. In order to determine which specific changes are needed in the existing model, insight into international service contracting issues obtained from the case study performed is considered. In particular, concepts developed to reflect contract parties, service offerings, service bundling, and typical contract elements reflect case study insight.

The existing concept model depicted in Figure 5.3 shows relevant concepts and their interrelations from a service provider perspective. This perspective is appropriate for the existing model, since that model adopts an SLM point of view. The management of an already contracted service lies primarily within the domain of the service provider. Accordingly, the service provider is not reflected by means of a specific concept. Consequently, only concepts

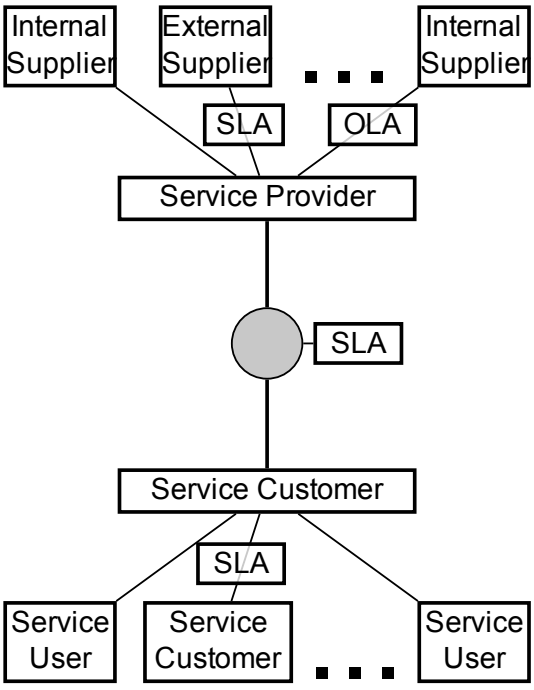


Figure 5.2: Extended Customer/provider Relationship

for those organizational domains with which a service provider interacts — again, from an SLM point of view — are included in the existing model.

For the concept model of relevance here, however, SLM-driven concepts are required to be complemented by the relevant set of contracting concepts. As a contract is a mutual agreement, the inclusion of contracting concepts requires to reflect the respective involved contract parties equally. Considered contract parties embrace exactly one service provider and exactly one service customer (both being of type `ContractParty`). On the other hand, concepts of type `ServiceDeliveryParty` are not focused on here, so that these concepts can be neglected — which, however, does not imply that these concepts are not relevant.

Driven by the existing model shown partially in Figure 5.3, a first set of adaptations for the extended concept model of relevance to this work is summarized as follows:

- Concepts for both considered contracting parties are included. The existing concept `Customer` is renamed to `ServiceCustomer`, complemented by its counter-part concept, `ServiceProvider`. `ServiceCustomer` and `ServiceProvider` inherit from the (newly included) concept `ContractParty`.

- `ServiceDeliveryParty` concepts (including concretized concepts of `InternalDeliveryParty` and `ExternalSupplier`) are abstracted away from the concept model.

In direct consequence of including contracting concepts, those two existing concepts for services and SLAs have to be complemented by the respective counter-concept from a contracting perspective, the `ServiceContract` concept. The existing concept model knows contractual concepts as well. These include on the one hand concepts representing specializations of the concept `Agreement`, namely `ServiceLevelAgreement`, `OperationalLevelAgreement` (OLA), and `SupportiveAgreement`. On the other hand, contractual concepts include the `AgreementConflict` concept as well as the concept of `UnderpinningContract`. With the exception for `ServiceLevelAgreement`, these concepts listed are abstracted away from the concept model. With respect to concepts for OLAs and for underpinning contracts, this happens as a consequence of abstracting `ServiceDeliveryParty` concepts. `Agreement` and the associated `AgreementConflict` concepts are masked in order not to confuse concepts that are newly included by introducing the `ServiceContract` concept. Before explaining adaptations required by `ServiceContract`, a second set of adaptations for the concept model is summarized as follows:

- The concept for `ServiceContract` is included as a central contracting concept.

- `SupportiveAgreement` concepts (including concretized concepts of `OperationLevelAgreement` and `UnderpinningContract`) are abstracted away from the concept model.

- `Agreement` (including associated concept of `AgreementConflict`) is abstracted from the concept model due to a potentially misleading interpretation of the `ServiceContract` concept in the context of this work.

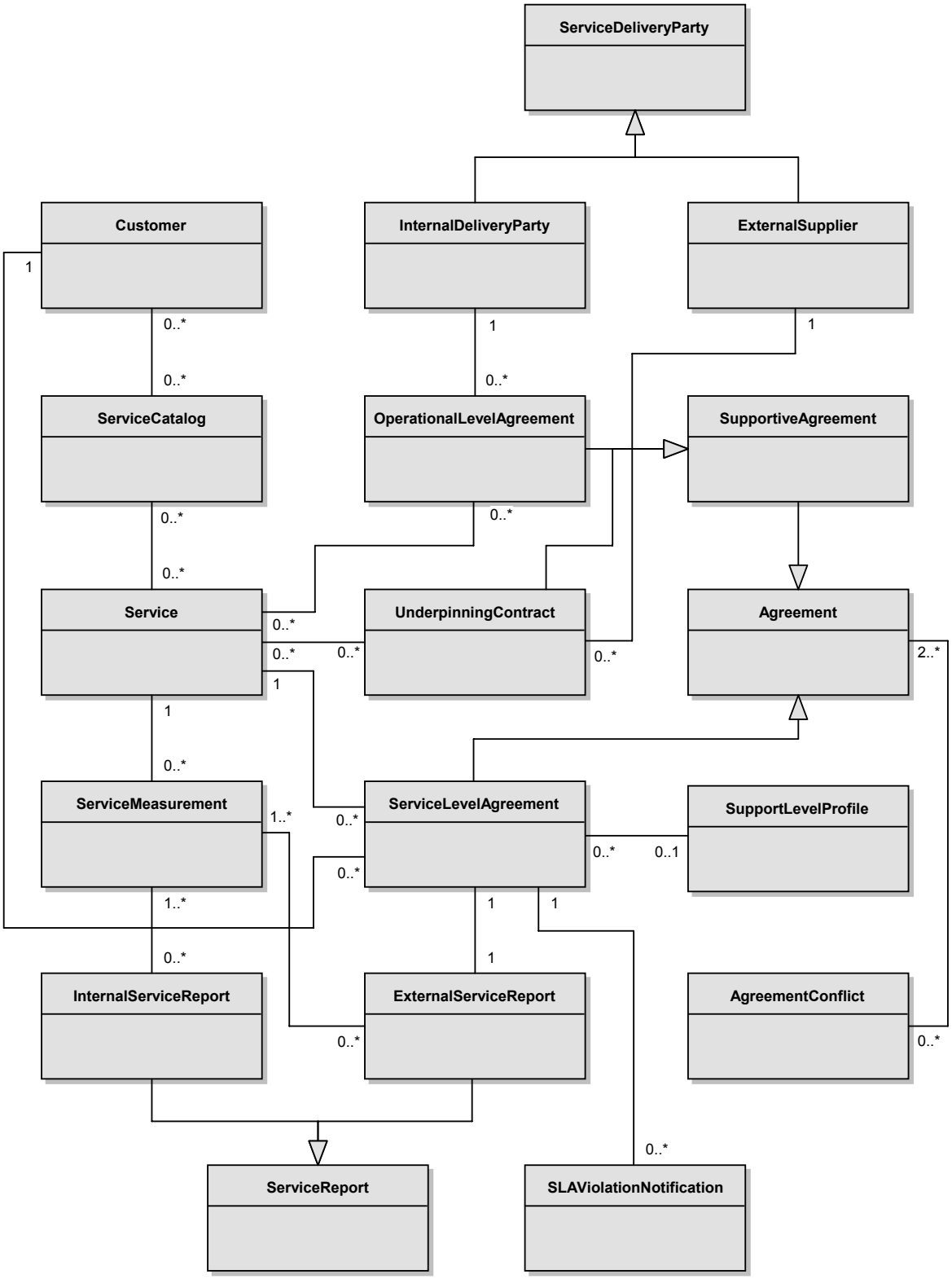


Figure 5.3: Partial View on the Existing Concept Model [77]

ServiceContract, ServiceLevelAgreement, and (the abstracted) Agreement concepts are content-wise closely related to the outlined scope of this thesis. Nevertheless, these concepts have to be clearly differentiated. While, from an SLM perspective, an SLA constitutes the primary contractual element of interest to a service provider and a service customer, an SLA is usually a single contract part only when considering the full contractual agreement concluded between a service provider and a service customer.

The performed case study shows a typical example of such a complete contract construct. It is important to note that a contract construct consists of multiple contract parts. There are either generally applicable or specific to a service covered by the overall service contract. There may be one or several services (including all relevant service-specific contract parts) to be considered within the frame of a single service contract. These different contract parts are addressed part by part later on. At this stage of concept model development, though, the primarily relevant consequence out of the case study investigated is that ServiceLevel Agreement probably remains the central service contract part from an SLM perspective, since an SLA reflects those contract elements that may be associated with accountable units, whereas — from a contracting perspective — an SLA obtains less weight as it is a single contract part in a row of other, equally important contract parts, all of which are covered by a single service contract.

This implies two things. First, ServiceContract and ServiceLevelAgreement may be both of type Agreement. In order to not emphasize, however, that what a service customer and service provider conclude is a (complete) service contract and not an SLA alone, Agreeement is masked. Second, the relation between a contract and an SLA is as such that a service contract shall cover at least one contracted service which might or might not have an SLA attributed. An SLA cannot exist for itself, meaning it does not constitute a contract of its own. It constitutes a contract part. Due to an SLA's acknowledged importance from an SLM point of view, however, the concept of ServiceLevelAgreement is perceived to feature a dual contracting/management characteristic. Consequently, the extended concept model as shown in Figure 5.4 introduces the respective domains of contract management and service management. Each concept is placed in either the contract management domain or the service management domain — the only exception being ServiceLevel Agreement which is placed at the edge of both domains in order to emphasize its dual characteristic as described.

Analogously, the extended concept model emphasizes for each concept covered whether a concept is more closely related to the customer or to the provider domain, respectively. To that aim, a concept is placed in either domain. Concepts, in which both contract parties have an equally important stake, are placed at the edge of both domains. This includes on the one hand all contract parts, since a contract is by definition a mutual, ideally balanced, agreement. On the other hand, the concepts Service and ServiceCatalog are placed at the edge of both, customer and provider domains, to clarify that the extended concept model gives equal weight to both contract parties — one of which using and paying for a service, one of which providing and managing a service, both of which having contractual obligations of equal weight to fulfill. In that sense, a third set of adaptations for the extended concept model is summarized as follows:

- Contract management and service management domains are included. Concepts are placed according to their relation to either one or both domains.

- Customer and provider domains included. Concepts placed according to relation on either one or both domains.

As previously stated, some contract parts are general, while others are service-dependent. A typical example for generally applicable — service-independent — contract elements are a frame contract (to be subsumed under the concept of `ServiceContract`) and general terms and conditions (to be subsumed under a newly introduced `GeneralTermsAndConditions` concept). A service contract might see none, one, or several contract elements that may fall under the concept `GeneralTermsAndConditions`, but typically either none or exactly one general terms and conditions contract part is assumed.

In the same way that terms and conditions may apply to a service contract as a whole, terms and conditions may apply to a specific service covered by a service contract. Thus, a (service-specific) concept of `TermsAndConditions` is introduced and associated with the `Service` concept. A service may have zero, one, or several terms and conditions documents attached. Both, general terms and conditions as well as service-specific terms and conditions are placed in the contract management domain. Terms and conditions constitute important contracting instruments, whereas they show only little direct impact in the service management domain — at least as long as there is no technical metric to be observed which would originate from a terms and conditions document.

Additional typical contract elements with a service dependency comprise acceptable use policies (none, a single, or multiple policies per service) and SLAs. While SLAs and the respective concept were previously discussed content-wise, the placement of `ServiceLevelAgreement` is a special one. `ServiceLevelAgreement` is placed at the edges of contract management and service management domains as well as at the edges of customer and provider domains. The first is due to its dual characteristic as described, the second is due to an SLA's nature of a contract element. `ServiceLevelAgreement`, thus, sees a fourfold characteristic with respect to related domains. With these service-specific and contract-general concepts outlined, a fourth set of adaptations for the extended concept model is summarized as follows:

- Typical contract-general concepts, such as `GeneralTermsAndConditions` and (the previously introduced) `ServiceContract`, are included. These concepts usually see a stronger relationship with the contract management domain than with the service management domain.

- Typical service-specific concepts, such as `GeneralTermsAndConditions`, `AcceptableUsePolicy`, and `ServiceLevelAgreement`, are introduced.

The existing SLM-driven concept model implies a provider perspective, and it covers a `Customer` concept. With the introduction of a contract management and a service management domain, the need for a differentiated approach to contracting parties and service using/provisioning parties becomes apparent. This is why the two concepts of `ServiceCustomer` and `ServiceProvider` — both perceived as concepts relevant to the contract management domain — need to see a direct counter-part in the service management domain. From a service management point of view, it is less important who signed and pays for a contract (service customer), it is also less important who counter-signed a contract (service provider), while it is of key importance who consumes a service, and, consequently,

who makes a service available. Accordingly, the contract-driven concept for a service customer is complemented by a service management-driven concept for a service user. And the contract-driven concept for a service provider is complemented by a service management-driven concept for a service operator. In some cases, a service customer and a service user may represent a single physical entity, namely a single natural person. The same might be true analogously on the provider/operator side for a specific contract/service. Nonetheless, these two concepts each are kept separate to emphasize a differentiated notion with respect to the according domain (contract or service management domain) a concept belongs to. In this sense, a fifth set of adaptations for the extended concept model is summarized as follows:

- Management-driven concepts of `ServiceUser` and `ServiceOperator` are included as a complement to their respective contract-driven concepts of `ServiceCustomer` and `ServiceProvider`.

Finally, a number of SLA-related concepts of the existing model is masked, whereas the two closely related concepts for services and service catalogs are kept in the extended concept model. The set of masked concepts embraces `ServiceReport` (including concretized concepts for internal and external service reports), `ServiceMeasurement`, `SLAViolationNotification`, and `ServiceLevelProfile`. All these concepts are abstracted for a similar reason, which is that these concepts are primarily service management-relevant. Hence, these SLA-oriented concepts are not explicitly mentioned in the extended concept model, but they are neither excluded completely.

In contrast, `Service` and `ServiceCatalog` are prominently referred to in the extended concept model due to their importance from a contractual and a service management perspective. Despite being placed in the service management domain, services and service catalogs determine by definition key objects of any service contract. A service contract is understood to cover a service catalog, which reflects a customer-specific instance of a set of contracted single services. Accordingly, concepts for service contracts and service catalogs are associated with each other. `ServiceCatalog`, in turn, refers to services (and with that to the concept of a service), while services see service-specific contract elements. A service contract is assumed to refer to at least one service catalog. A service catalog, analogously, is assumed to include at least one service.

In conclusion and in order to complete explanations on how to find from the existing SLM-driven concept model depicted in Figure 5.3 to the extended concept model depicted in Figure 5.4, a sixth set of adaptations is summarized as follows:

- `ServiceReport` concepts (including concretized concepts of `InternalServiceReport` and `ExternalServiceReport`) are abstracted away from the concept model. Accordingly, the `ServiceMeasurement` concept (basis to prepare `ServiceReport`) is abstracted away from the concept model.

- Concepts related to `ServiceLevelAgreement` with a primary management focus — `SLAViolationNotification` and `SupportLevelProfile` — are abstracted away from the concept model.

- Management-driven concepts of `Service` and `ServiceCatalog` are used from the existing model. `ServiceCatalog` is associated with the `ServiceContract`

concept. The `Service` concept is associated with the service-specific contract part concepts.

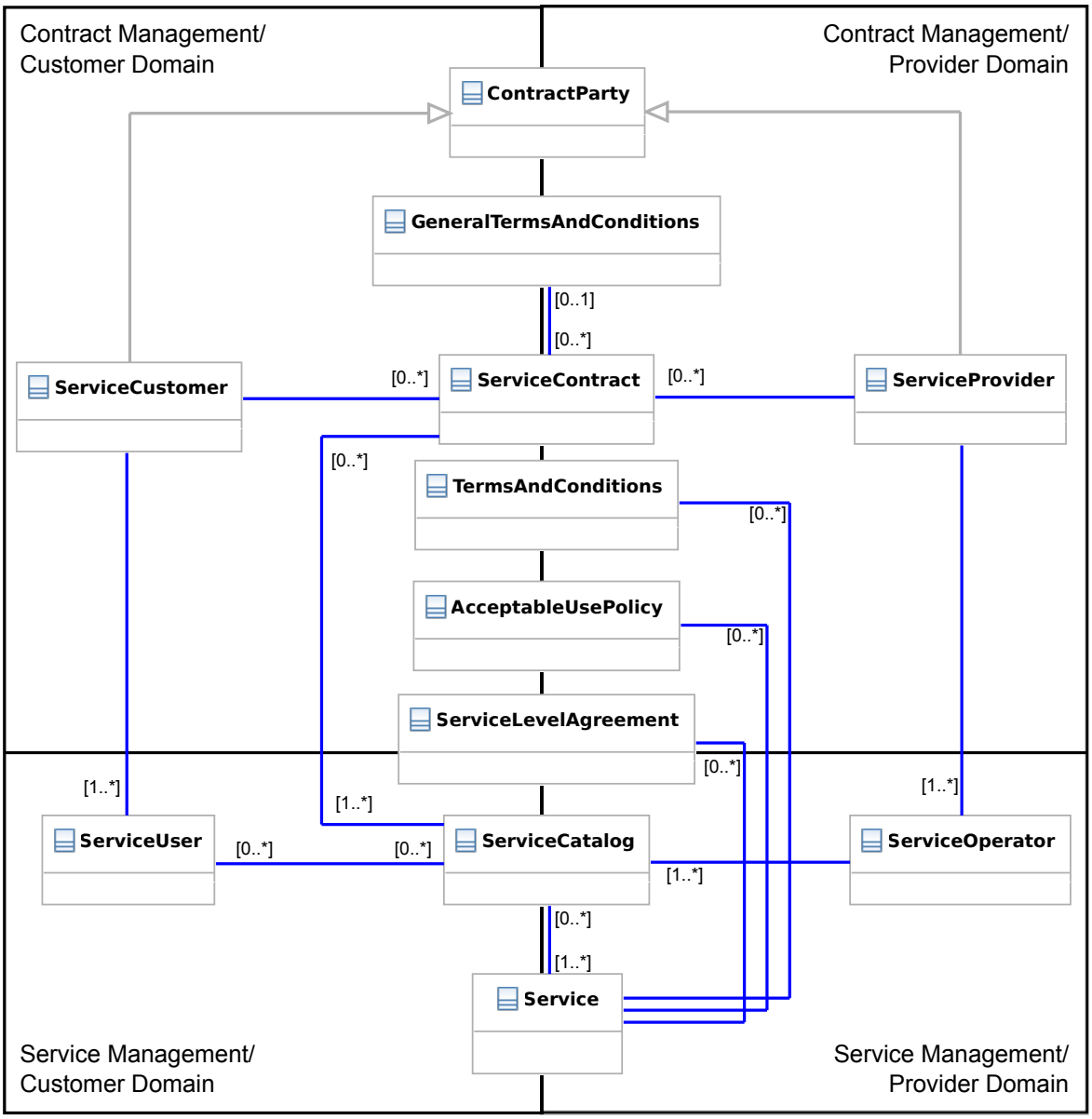


Figure 5.4: Adapted Concept Model (Outline)

## 5.3 Artifact Model

Driven by the concept model adapted, this section is concerned with the modeling of specific, related information objects (information artifacts) required for a PIL-conforming determination of jurisdiction and applicable law. Once those goals listed for a concept model (*cf.* Section 5.2) have been answered, a refinement of the concept model into data models reflecting specific artifacts needs to be performed. This addresses the following tasks:

- Refining the informational requirements of the determined information objects so that they may be formalized as data models.
- Determining specific data models resulting from the set of information object classes identified.
- Integrating all data models into a single consistent information system for SLM.

In order to address these tasks accordingly, specific information artifacts — required for a PIL-conforming determination of jurisdiction and applicable law recommendations — have to be determined. These artifacts, thus, reflect connecting factors which, in accordance with a specific PIL modeled, serve as main input to produce a list of recommendations. Table 5.1 documents the respective set of connecting factors to be know from a European PIL point of view.

Jurisdiction-oriented factors are derived from the Brussels I regulation [26], while applicable law-oriented factors originate from the Rome I regulation [37]. These connecting factors have been collected when assessing and modeling these regulations according to the PIL modeling method introduced in Chapter 6. Hence, the concept model is concretized by means of specific artifacts — connecting factors — whenever a new PIL source is studied and modeled. Beyond this inter-dependency between information model and PIL modeling method, an equally pronounced inter-dependency between information model and implementation method (Chapter 7) exists: information artifacts constitute the primary input and output parameters for an implemented decision support system as foreseen here.

Figure 5.5 shows the accordingly determined artifact model. It represents a partial model which focuses on information artifacts in relation to the concept of `ContractParty`, *i.e.*, in relation to a service customer and a service provider. The respective set of information artifacts needed to determine jurisdiction and applicable law recommendations for a service contract to be formed is twofold. First, and besides an artifact to uniquely identify a contract party, a number of artifacts are needed to characterize a service provider or a service customer. These artifacts cover location-oriented connecting factors, such as a contract party's location of domicile, establishment (or establishments), and habitual residence. Furthermore, a contract party is characterized by an object reflecting a party's business role in a considered contractual relation, namely whether a party is provider or customer. In case a provider is assumed to represent a professional service supplier of services, while a customer is assumed to represent either a private, non-professional (B2C, Business-to-Consumer) or a professional buyer (B2B, Business-to-Business), a customer may or may not be a consumer, respectively. To express this, the respective artifact `Consumer` is included in Figure 5.5.

Moreover, a second dimension to characterize a contract party is reflected in Figure 5.5 by a number of artifacts representing a party's (potential) wish to make a choice of jurisdiction and/or a choice of law. If a contract party envisages a choice, its preferred jurisdictions and laws, respectively, are modeled in the respectively included artifacts. In case of a choice of jurisdiction, this choice can be termed exclusive or non-exclusive. It is important to note that these artifacts mentioned in relation to a contract party are reflected in Table 5.1 as well. In Table 5.1, however, these factors are attributed to a (service) contract. Figure 5.5, as a partial information model emphasizing on contract parties, provides an elaborate overview of artifacts that reflect each contract party's characteristics and preferences, while it does not elaborate in full detail on artifacts telling about whether both parties actually find agreement

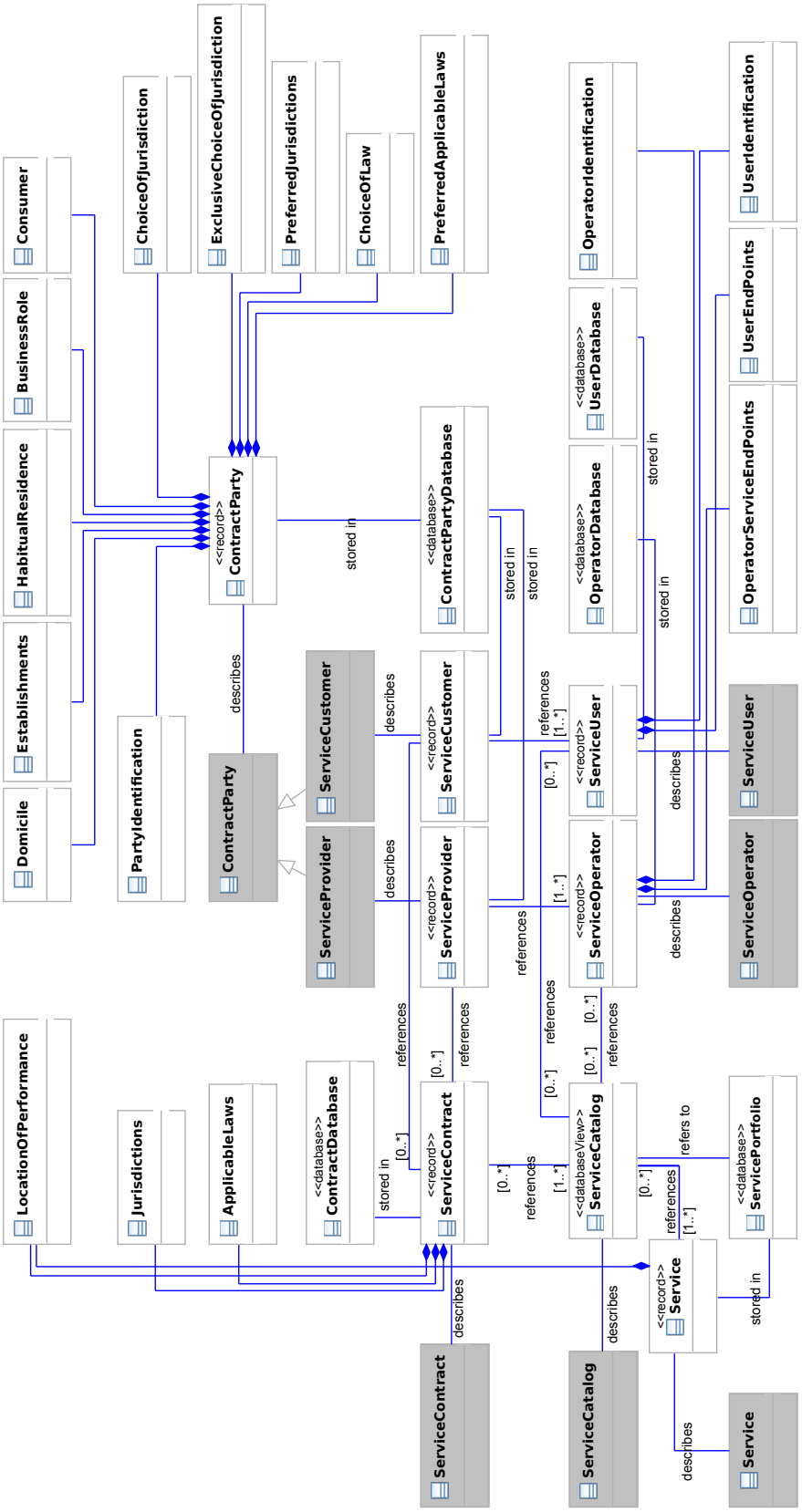


Figure 5.5: Partial Artifact Model

Table 5.1: Relevant Connecting Factors in Brussels I and Rome I Regulations

| Dimension | Connecting factor | Remark |
|---|---|---|
| Contract party | Domicile | Location (state is sufficient) |
| | Establishment(s) | Location (state is sufficient) |
| | Habitual residence | Location (state is sufficient) |
| Contract | Contract type | Only service contracts considered here |
| | Performance | Location (state is sufficient) |
| | Choice of jurisdiction | Boolean, either “yes” or “no” |
| | Chosen jurisdiction | Location (state sufficient, representing court or courts of a state), only relevant if choice of jurisdiction made (“yes”) |
| | Exclusive choice of jurisdiction | Boolean, either “yes” or “no”, only relevant if choice of jurisdiction made (“yes”) |
| | Choice of law | Boolean, either “yes” or “no” |
| | Chosen law | Location (state sufficient, representing law or laws of a state), only relevant if choice of law made (“yes”) |
| | Consumer contract | Boolean, either “yes” or “no” (implies B2C service provisioning if “yes”, B2B provisioning if “no”) |
| | Provider target Markets | Location (state is sufficient), only relevant in case of consumer contract (“yes”) |
| Dispute | Defendant | Contract party (implies that the respective other contract party in a bilateral contract is claimant) |
| | Dispute matter | Only disputes in relation to either a contract/contractual claim or operation of an establishment considered here |
| Result | Jurisdiction(s) | Location (state sufficient, representing court or courts of a state) |
| | Applicable law(s) | Location (state sufficient, representing law or laws of a state) |

according to their mutual preferences so that a contract might see a choice of jurisdiction and/or of applicable law (and if yes, which choice).

Similarly, the partial model in Figure 5.5 includes a generic, *i.e.*, not further differentiated, artifact for jurisdiction(s) and applicable law(s). This is, contrary to those artifacts discussed previously, in line with those two result-oriented connecting factors mentioned in Table 5.1. During law modeling (*cf.* Chapter 6) and implementation work (*cf.* Chapter 7) conducted, however, it was found that there are different notions of jurisdiction and/or applicable law to be considered. For instance, notions for unwaivable jurisdiction, jurisdiction for service customer claims and jurisdiction for service provider claims, (non-exclusive or exclusive) chosen jurisdiction, jurisdiction for claims in relation to operation of an establishment, and a notion for general non-exclusive and exclusive jurisdiction need to be clearly separated and handled accordingly. These different notions are subject to detailed discussion in the respective modeling and implementation sections, while Figure 5.5 includes generic artifacts for jurisdiction(s) and applicable law(s) at this point.

Finally, those dispute-driven connecting factors of Table 5.1 do not find representation in the artifact model at all. PIL sources, such as the Brussels I and Rome I regulations, typically contain provisions that presume there is a dispute out of an earlier concluded contract. For PIL, this assumption is a valid one — without a dispute, a court would not have to decide whether it has jurisdiction to hear a case (and if yes, under which nation’s material law). For the purposes of this thesis, however, which encompasses an information model reflecting artifacts needed to determine jurisdiction/applicable law at the time of contract formation,

no information about any potential future conflict can be taken. The modeling method and implementation documented in subsequent chapters address this fact by modeling PILs in a way that circumvents provisions in dependence of knowledge about a dispute.

## 5.4 Information Model Summary

With the aim to provide a solid and common basis to the law modeling of Chapter 6 and the implementation of Chapter 7, the according information model has been developed as documented within the chapter at hand. The information model consists of a concept model and an artifact model. The first represents an adaptation of an established information model in SLM which was largely extended so that the resulting concept model covers equally aspects of service and contract management.

This was achieved on the basis of the respective customer/provider relationship to be assumed in this thesis. This relationship, which finds expression in the according contractual relationship to be expected, focuses on a bilateral relationship in which a single service customer and a single service provider agree on a (potentially) international service contract. Both developed models, incorporate the according set of service management- and service contract-related concepts and artifacts, respectively. For instance, artifacts cover important connecting factors in international service contracts (contracting perspective) and concepts differentiate between a service user entity (service management perspective) and a service customer entity (both perspectives).

Consequently, while this thesis' first major contribution consists in the detailed understanding of international service contracts obtained by the case study conducted, this thesis' second major contribution is found in the information model developed. Both the concept and the artifact model facilitate a bridging of the modeling method and, especially, the resulting activity diagram with the subsequent design and implementation as detailed in Chapter 7. In particular, in- and output variables used in the implementation (reflecting connecting factors or jurisdiction-oriented information) are in direct relation to the concepts and artifacts embraced in the information model.

# Chapter 6

# PIL Modeling Method

Driven by the motivation outlined and the set of PIL modeling method requirements identified, the according PIL modeling method has been developed. This chapter documents the PIL modeling method in full detail. The method is structured into three major thematic blocks. These cover PIL identification and selection, PIL analysis, and activity diagram modeling. The first block is concerned with identifying and selecting relevant legal sources in PIL. Once identified, a selected PIL undergoes a thorough, multi-step analysis to assess modeling relevance of law sections and single provisions included in the PIL in question. This block of PIL analysis bases on the relevant set of in-/exclusion criteria which have been defined to facilitate a relevance assessment. Those provisions which were found relevant are then considered for a formal PIL work flow modeling by means of UML2 activity diagrams. In addition to an in-depth documentation of the PIL modeling method, this chapter shows its application to an example PIL, the Brussels I regulation. Brussels I, thus, is analyzed content-wise, relevant provisions are identified, and the according activity diagram is developed and explained.

The approach taken with three thematic blocks (and the respective set of sub-steps in each block) reflects the complexity and the importance of a successful PIL modeling. As important as the information model and a correct implementation of a modeled PIL are, it is the modeling output that determines the overall expressiveness and significance of the envisioned DeRISC decision support system. As such, it is crucial that the set of relevant PILs is identified. It is equally crucial that any identified PIL is assessed in terms of relevant provisions as well as that relevant provisions are modeled in a way that allows for an implementation as foreseen. In particular, the second and third block of PIL analysis and activity diagram modeling are exposed to a high level of complexity. Consequently, the PIL modeling method determines for these blocks the comprehensive set of criteria and formal requirements to be considered.

## 6.1 Evolution of the Approach

The modeling method developed and introduced takes input from an initial PIL modeling effort [103] in the sense that select methodological elements and lessons learned form the basis on what this modeling method is built upon. In particular, the main part of inclusion and exclusion criteria considered originates from that initial modeling effort. While some

parts of the modeling method presented here, thus, reflect initial input, major modeling steps were so far either missing or only marginally addressed. For instance, good practice on how to model relevant PIL provisions as UML2 activity diagrams was lacking. Hence, the modeling method as presented here finds its roots in those selective procedures documented in the initial modeling effort, while it has stabilized over time and considerably widened in scope, so that it now represents a modeling method in an embracing and structured manner.

The modeling method is presented by means of a concrete PIL to be modeled. This example PIL is the Brussels I regulation [26]. Brussels I represents the primary (supra-national) PIL in jurisdictional questions for most EU member states. It has a parallel convention, the Lugano Convention [64], which brings the directly comparable set of jurisdiction provisions to ratifying associated states (in particular, the 2007 revision [65] of the Lugano Convention is directly comparable with Brussels I). Even though Brussels I was the example PIL to be modeled in the initial modeling effort as well as it is here, the resulting activity diagram in this chapter is substantially different from the diagram drawn earlier (*cf.* Figure 2.6).

This is due to methodological differences as previously explained. One major deviation of note is found in the fact that Figure 2.6 bases on the existence of a dispute and the according understanding of a defendant and claimant. The existence of a dispute is a valid assumption for any PIL as a court would only become active after that a dispute-related claim was deposited. Figure 2.6 is modeled directly after the law and does not question the existence of a dispute.

Since this thesis, however, aims at an automated determination of PIL-relevant contract parameters at the time of contract formation — when none of the involved contract parties have knowledge about any potential future dispute —, the modeling methodology presented here had to find a way around any dispute-driven clause. Disputes had to be handled in a pro-active way, so to say. This implies that any PIL provision that bases on a dispute and the respective role of a defendant or claimant had to be time-wise ported to the time of contract conclusion. Therefore, this modeling method foresees wherever needed parallel cases for a service provider and a service customer potentially being defendant and claimant, respectively.

Overall, the modeling method documented in this chapter contributes to this work in terms of a conceptual framework. This framework, thus, embraces a comprehensive and highly structured method to identify, analyze, formally model, and implement (covered in Chapter 7) multiple PILs based on identified thematic topics as well as on an integrated information (covered in Chapter 5) and work flow model.

## 6.2 PIL Identification and Selection

This first step of identifying and selecting PILs for a subsequent modeling is a fundamental one. Only those PILs which were found, assessed relevant, modeled, and finally implemented may be used in order to determine lists of recommendable jurisdictions and/or of recommendable applicable laws. The set of considered PILs defines the overall system's geographical reach in terms of jurisdictions and international contractual relations covered. If, for instance, a contract between a service provider domiciled in the USA and a service customer domiciled in Switzerland shall be concluded and if DeRISC lacks only one of the three relevant PIL perspectives here — the two national PILs as well as any potential

supra-national PIL source applicable —, then there is a substantial chance any determined recommendation list misses important entries.

### 6.2.1 Identification Guidelines

Despite the fact that the range of covered PILs defines the overall expressiveness of DeRISC, the procedure to identify PILs must be admitted to lack a fully satisfying method. This is mainly reasoned by an inherent territorial principle in law and the according principle of state sovereignty. Multiple legal traditions have emerged over time in different regions of the world [43]. Consequently, while one nation might have codified PIL provisions in the form of a dedicated national law, another nation might base completely on case law, build a collection of procedural rules, or might not even trade its law in written form. These are just a few examples mentioned. In addition to these legal tradition-driven obstacles, a number of more practical hurdles originating from international diversity has to be considered. In particular, PIL sources might be available, but in a language requiring translation services. The important conclusion here with respect to a structured method with reproducible results is that there is probably none, at least not a universally applicable one.

On the other hand, general guidelines may be outlined to identify relevant PIL sources. The following short list of common sources has been compiled. This list is not meant to be encyclopedic. Nonetheless, experience in the process made shows that by looking into those types of common PIL sources listed the key set of PILs relevant for a jurisdiction of interest is obtained:

**National law compilations** — Many states and supra-national organizations nowadays keep an up-to-date compilation of national and international law, very often even in an online, searchable, and freely accessible manner. This is an excellent comprehensive source to identify potentially relevant PILs as these compilations typically include or refer to all national and supra-national laws, regulations, treaties, and conventions of relevance for a given single state or supra-national organization.

**Court decisions and civil procedure rules** — Especially in those jurisdictions with a case based legal tradition, collections of key court decisions determining PIL-relevant precedence constitute a primary source of investigation. In some cases, conflicts of law provisions are even documented and updated in the respective set of civil procedure rules.

**Books, articles, and commentaries in PIL** — PIL and conflicts of law is an area of law which imposes multifarious, considerable, and non-trivial challenges to be addressed. Consequently, this field attracts researchers to investigate these problems and publish results in terms of books, scientific articles, and legal commentaries. This type of PIL source is typically focusing on a specific issue within the domain and may cover (often compare) several PILs. Books, articles, and commentaries, thus, often contribute as meta sources, while the first two mentioned PIL sources are regarded as primary sources.

**Specialized web sites** — As there is a wide variety of work done in PIL and PIL research by an equally wide range of different stakeholders, specialized web sites help collect and aggregate relevant information, actions, and trends for an interested audience.

### 6.2.2 Selection Criteria

Unlike the procedure to identify PILs of potential relevance, the method to select an identified PIL for further analysis, modeling, and implementation follows a specific set of selection criteria. These criteria are well-determined by virtue of the specific contractual object considered here. This contractual object is related to the type of service and, with that, the type of business transaction considered. Accordingly, the set of determined criteria is driven by an underlying question of whether or not a given PIL is applicable to the type of service and type of business transaction of relevance in this work. A PIL is selected if (and only if) all of the following selection criteria are met:

**Provision of services** — This criterion is met if a PIL in question is applicable explicitly (by statement in the law itself) or implicitly (by prevailing case law or by prevailing opinion) to business transactions consisting completely or predominantly in the provisioning of services (as opposed to production and/or delivery of goods). This work focuses on commercial electronic services in the Internet (*cf.* Section 2.7). The provision of this particular type of service is assumed to be included in a general, non-specific definition of service provisioning.

**Civil and commercial matters** — This criterion is met if a PIL in question is applicable to legal matters that fall under civil law (as opposed to penal or public law) and that embrace a commercial offering. In the current context, commercial offering implies a provisioning of services (as previously described) for compensation of some sort (primarily in monetary terms). Such commercial service provisioning is furthermore assumed to require a service contract to be concluded. This service contract is foreseen here to involve exactly one service provider and exactly one service customer (bilateral contract), whereas the respective service offering is expected to be endorsed by a service provider's professional or commercial activities. On the other hand, an involved service customer is expected to conclude such a service contract both, either within or outside his or her professional and commercial activities. In other words, a PIL must be applicable to service contracts that cover civil and commercial mattes reflecting electronic business in a Business-to-Business (B2B) or Business-to-Consumer (B2C) manner.

**Connection to multiple jurisdictions** — This criterion is met if a PIL in question is applicable to a relation with a connection to multiple (at least two different) jurisdictions and/or their laws. It is within the considered PIL's scope to define connecting factors that may relate a service contract or the contracted service provisioning to multiple jurisdictions and/or their respective laws. Prominent examples of connecting factors are a contract party's presence in a jurisdiction (*e.g.*, domicile, habitual residence, market activities, property) and contractual obligation-related characteristics (*e.g.*, location of performance) as well as a contract party's explicit or supposed will (*e.g.*, choice of jurisdiction, choice of law).

**International connection** — This criterion is met if a PIL in question is applicable to relations with international connection (as opposed to intra-national inter-state connection). Thus, touched jurisdictions must not relate to federated states (or comparable

legal domains) of a single sovereign state. Touched jurisdictions must relate to different sovereign states — to different "nations" in informal terms. Accordingly, a considered PIL represents law on either national or supra-national level. Should a considered law cover provisions of intra-national inter-state and of international scope at the same time, the criterion is assessed met, but only with respect to those provisions that involve an international connection.

**Hierarchy** — This criterion is met if a PIL in question can be attributed a distinctive place in a hierarchy of identified PILs of national and supra-national level. In the context of a sovereign state and all state-relevant PIL sources of national and supra-national level (*e.g.*, this state's national PIL and bi- or multilateral PIL-related conventions/regulations accessed and ratified), each single PIL source must be defined as to which other PILs this PIL is superior and inferior to. This means that for every considered jurisdiction, the set of relevant PILs must be built and equipped with the respective set of subsidiarity relations between those PIL instruments embraced by that set. Typically, national PIL sources are subordinate to supra-national PIL sources.

**Validity** — This criterion is met if a PIL in question is in force, *i.e.*, it is valid at a given moment in time. In this context, that moment in time is related to the time of contract conclusion. Since this work includes a time-wise porting from a potential dispute arising from contract to the time that contract was concluded, PIL validity is — strictly seen — not fully satisfied when checking validity only at the time of contract conclusion. There is a chance that a list of recommended jurisdictions/applicable laws was determined at contract conclusion according to a PIL which was in force at that time, whereas that same PIL was not in force anymore at the time an actual dispute arose and was brought to court. In this case, it might be that a recommended jurisdiction could not be substantiated at the time of dispute as another PIL in force then might state conflicting provisions. This issue is well acknowledged here. It is seen as an eventual challenge which contract parties should be aware of. Since its existence is of systematic nature and since no obvious solution to it is available without substantial change to the overall methodology required, it cannot be easily overcome.

**Ratification** — This criterion is met if a PIL in question is ratified by a sovereign state in question. In other terms, for a given PIL the respective set of member states that have ratified that PIL needs to be known at the time of contract conclusion. In principle, the same reservation with respect to validity is present with respect to the criterion of ratification. The chance, however, that (a) a PIL was ratified by a considered state before contract conclusion, that (b) this state had abandoned the PIL in question in the time span after contract conclusion and before a dispute was brought to court, while (c) this PIL is still in force at the time of dispute, is assessed rather low. Therefore, the reservation is seen here to be of a more theoretical nature.

For the given example of investigation here, the Brussels I regulation, all criteria are met. Accordingly, Brussels I is applicable to the provision of services. It is applicable to many other (non-considered) legal relations as well. Provisioning of services is explicitly mentioned in multiple Articles, *e.g.*, Article 5(1)(c). Brussels I is applicable to civil and commercial matters (prominently mentioned in the regulation's title as well as in Article 1(1)). Furthermore,

the regulation refers in the vast majority of included provisions to relations with connection to multiple jurisdictions, and the majority of these cases involves international connection between the regulation's member states which are sovereign states despite being member states of the EU. Finally, Brussels I's relation to other instruments has been clarified, the regulation is in force at the time of writing this thesis, and the set of ratifying states has been determined.

## 6.3 PIL Analysis

After a PIL of interest was identified and successfully selected for modeling and implementation, the PIL in question undergoes a detailed analysis. This analysis follows a two-step approach. First, a thematic pre-selection is conducted. A PIL typically covers a wide area of legal transactions and/or contract types. Based on the respective contractual object notation adopted here (see, *e.g.*, selection criteria outlined in Section 6.2.2), a considerable share of PIL sections addressing non-considered areas can be excluded *ex ante*, meaning without proceeding with step two, the detailed in-/exclusion assessment of single articles or parts of thereof. Thus, this two-step approach pre-selects in a first step PIL sections which seem worthwhile for detailed investigation as well as it un-selects PIL sections which, for a documented reason, need not to be assessed in detail.

### 6.3.1 Inclusion and Exclusion Criteria

Table 6.1 lists the set of those reasons for inclusion or exclusion, including for each in-/exclusion criterion a three letter mnemonic code. The same list is equally used in the first and second PIL analysis step, in the coarse-granular pre-selection step as well as the detailed in-/exclusion assessment step, respectively. This list bases partly on those criteria introduced and reasoned in [103] (*cf.* pages 21-22). While those reasons given for a criterion in the original list are seen valid and, thus, unchanged as of today — the only exception being previously excluded annex sections —, the list shown in Table 6.1 has seen substantial extensions over the original list. These extensions are driven by a wider experience gained in analyzing further sources such as the Swiss federal PIL [19] (on jurisdiction and applicable law) and the EU's Rome I regulation [37] (on applicable law). In this context, the list in Table 6.1 shall be understood as a comprehensive list from a current perspective, however, with a reservation of potential future extensions being possible and foreseen when the need for new, so far not addressed, criteria might become apparent due to the study of further PILs. This list, thus, is seen generally stable, nevertheless extensible.

With regard to inclusion criteria, the original list covered provisions related to jurisdiction/applicable law for consumer contracts (CCO), connecting factor definitions (COF), general jurisdiction/applicable law (GEN), and special jurisdiction/applicable law (SPE). The new list addresses all of these criteria plus two new criteria: Choice of jurisdiction/applicable law (CHO) and foreign jurisdiction (FOR) provisions were added. The first was previously subsumed in SPE. As CHO gains typically as much attention as CCO — which can be seen as a prominent case of SPE, too —, CHO is introduced as a separate criterion. In the example of Brussels I, jurisdictional questions of CHO are even treated in a section of their own. The latter, FOR, is introduced as a new criterion to differentiate from (excluded)

Table 6.1: Overview of Inclusion and Exclusion Criteria with Mnemonic

| | Mnemonic | Criterion |
|---|---|---|
| Inclusion criteria | CCO | Jurisdiction/applicable law for consumer contracts |
| | CHO | Choice of jurisdiction/applicable law |
| | COF | Relevant connecting factor definitions |
| | FOR | Foreign jurisdiction |
| | GEN | General provisions on jurisdiction/applicable law |
| | SPE | Special provisions on jurisdiction/applicable law |
| Exclusion Criteria | ADM | Admissibility |
| | ARB | Arbitration |
| | AUT | Authentic instruments; court settlements |
| | COC | Counter claim |
| | CON | Consent |
| | FIN | Final provisions |
| | INC | Incapacity |
| | LIA | Liability |
| | LPE | *Lis pendens* |
| | MOD | Modalities of performance and investigation |
| | MOT | Motives/recitals |
| | NCO | Non-considered contract types/legal actions |
| | PRF | Burden of proof |
| | PRO | Provisional and protective measures |
| | REC | Recognition; enforcement; judicial assistance |
| | REG | Regress |
| | REN | Renvoi |
| | RES | Reservations |
| | REV | PIL review |
| | SCO | Application scope; relations with other instruments |
| | SET | Set-off |
| | SUB | Subrogation |
| | TIM | Time limit and prescription |
| | TRA | Transitional provisions |
| | VAL | Material and formal validity |

provisions related to recognition, enforcement, and judicial assistance (REC). This follows an understanding that only those inter-jurisdiction issues are perceived relevant that have an impact at the time of contract conclusion. Recognition of a (foreign) decision by a state's courts requires existence of a dispute in (another) court after conclusion of a contract. Accordingly, recognition is not considered. On the other hand, provisions in a PIL that attribute jurisdiction to a foreign court are relevant when a list of recommended jurisdictions at the time of contract conclusion based on a given PIL shall be determined.

With regard to exclusion criteria, the original list covered provisions related to admissibility (ADM), consent (CON), final provisions (FIN), incapacity (INC), liability (LIA), *lis pendens* (LPE), motives/recitals (MOT), non-considered contract types/legal actions (NCO), burden of proof (PRF), recognition, enforcement, and judicial assistance (REC), reservations (RES), PIL review (PIL), application scope and relations with other instruments (SCO), set-off (SET), subrogation (SUB), transitional provisions (TRA), and material and formal validity (VAL). In addition to these, the original list was extended by the following new exclusion criteria: Arbitration (ARB), authentic instruments and court settlements (AUT), counter

claim (COC), performance and investigation modalities (MOD), provisional and protective measures (PRO), regress (REG), renvoi (REN), and time limit and prescription (TIM).

The reason to exclude provisions related to these newly introduced criteria is the same as for most already existing exclusion criteria. These provisions are perceived to be out of scope when taking this work's focus outlined as a reference value.

### 6.3.2 Thematic Pre-selection for Brussels I

Table 6.2 documents the respective results obtained by conducting a thematic pre-selection of provisions for the example of Brussels I. Based on those criteria listed in Table 6.1, Table 6.2 lists these Brussels I sections and chapters which were not selected *ex ante* for a detailed assessment, *i.e.*, sections and chapters which were excluded. For each excluded part, a mnemonic is provided. This mnemonic indicates the primary reason for which a part was not considered. In case of Annex V, two (instead of one) mnemonics are given in order to emphasize that this Brussels I part addresses both inextricably.

Table 6.2: Negative Thematic Pre-selection Assessment (Exclusion) for Brussels I Provisions

| Part | Section, Scope | Article | Mnemonic |
|---|---|---|---|
| **Motives** | none given | Motives 1-29 | MOT |
| **Chapter I** | Scope | 1 | SCO |
| **Chapter II, Jurisdiction** | Section 3, Jurisdiction in matters relating to insurance | 8-14 | NCO |
| | Section 5, Jurisdiction over individual contracts of employment | 18-21 | |
| | Section 6, Exclusive jurisdiction | 22 | |
| | Section 8, Examination as to jurisdiction and admissibility | 25-26 | ADM |
| | Section 9, *Lis pendens* – related actions | 27-30 | LPE |
| | Section 10, Provisional, including protective, measures | 31 | PRO |
| **Chapter III** | Recognition and enforcement | 32 | REC |
| | Section 1, Recognition | 33-37 | |
| | Section 2, Enforcement | 38-51 | |
| | Section 3, Common provisions | 53-56 | |
| **Chapter IV** | Authentic instruments and court settlements | 57-58 | AUT |
| **Chapter VI** | Transitional provisions | 66 | TRA |
| **Chapter VII** | Relations with other instruments | 67-72 | SCO |
| **Chapter VIII** | Final provisions | 73-76 | FIN |
| **Annex I** | Rules of jurisdiction referred to in Article 3(2) and Article 4(2) | Annex I | SCO |
| **Annex II** | none given | Annex II | REC |
| **Annex III** | | Annex III | |
| **Annex IV** | | Annex IV | |
| **Annex V** | Certificate referred to in Articles 54 and 58 of the Regulation on judgments and court settlements | Annex V | REC, AUT |
| **Annex VI** | Certificate referred to in Article 57(4) of the Regulation on authentic instruments | Annex VI | AUT |

On this coarse-granular level of thematic assessment it can be observed that Brussels I parts are excluded based on a limited number of reasons only. The most frequently given reason for exclusion is REC as a full Brussels I chapter and several annex sections deal with issues of recognition, enforcement, and judicial assistance. Furthermore, excluded Brussels I part cover recitals (MOT), scope definition (SCO), law parts relating to non-considered contract types or non-considered legal actions (*e.g.*, contracts of employment), special issues of admissibility (ADM) or *lis pendens* (LPE), provisional measures (PRO), final (FIN), or transitional provisions (TRA), and authentic instruments (AUT).

### 6.3.3 Detailed Inclusion and Exclusion Assessment for Brussels I

Table 6.3 visualizes why a two-step procedure as described and adopted here is meaningful when analyzing a given PIL. The second step, consisting of an in-depth analysis down to the detail of sub-paragraphs, parts of sentences and, sometimes, even single expressions, reflects a complex and time-consuming task. It is essential as it lays down the basis for any subsequent modeling and implementation, but due to its complexity it is feasible for a limited number of provisions only. Consequently, work load in this second PIL analysis step can be significantly lowered when it is conducted exclusively on a pre-selection of seemingly relevant provisions. On the other hand, it must be noted that a pre-selected provision is only a candidate for further analysis. Pre-selection alone does not imply a considered article is relevant in all parts. For instance, articles in Chapter II, Section 1 of Brussels I have been pre-selected. That section embraces three articles out of which one full article (Art. 4) and two single paragraphs of separate articles (Art. 2(2) and Art. 3(2)) have not been included for different reasons (see mnemonics in Table 6.3).

The negative pre-selection (exclusion) as documented in Table 6.2 results in a pre-selection of Brussels I provisions out of Chapters II and V. The latter is concerned with general provisions, including a number of important connecting factor (COF) definitions. Art. 60 defines the respective applicable notion of domicile for a legal person — in this context applicable to a service provider and to a professional service customer, since B2B and B2C business relations are envisaged here.

Other relevant connecting factor definitions are found in Brussels I sections that address primarily issues of general or special jurisdiction. These definitions cover the notion of location of performance for service provisioning (Art. 5(1)(b)-(c)), the understanding of a consumer (Art. 15(1)), of service provider market activities constituting jurisdiction (Art. 15(1)(c)), and of service provider domicile in relation to consumer contracts and claims out of operation of a service provider establishment (Art. 15(2)).

## 6.4 Activity Diagram Modeling

Subsequent to the two-step PIL analysis procedure, those provisions considered relevant are formally modeled in terms of a UML 2 activity diagram. Also this is done in a two-step manner in order to cope better with complexity. As PIL sources are usually structured thematically, a modeling of single thematic blocks is a considerably more straight forward task than modeling all selected provisions at once. Laws are by nature not meant to constitute

Table 6.3: Detailed In-/exclusion Assessment for Pre-Selected Brussels I Provisions

| | Section, Scope | Article | Provision | Inclusion (+) Exclusion (–) | Mnemonic |
|---|---|---|---|---|---|
| Chapter II, Jurisdiction | Section 1, General Provisions | 2(1) | *"Subject to this Regulation, persons domiciled in a Member State shall, whatever their nationality, be sued in the courts of that Member State."* | (–) | NCO |
| | | 2(2) | not cited | (–) | NCO |
| | | 3(1) | *"Persons domiciled in a Member State may be sued in the courts of another Member State only by virtue of the rules set out in Sections 2 to 7 of this Chapter."* | (+) | SPE |
| | | 3(2)-4(1) | not cited | (–) | SCO |
| | | 4(2) | not cited | (–) | NCO |
| | Section 2, Special Jurisdiction | 5 | *"A person domiciled in a Member State may, in another Member State, be sued:"* | (+) | SPE |
| | | 5(1)(a) | *"in matters relating to a contract, in the courts for the place of performance of the obligation in question;"* | (+) | SPE |
| | | 5(1)(b) | *"for the purpose of this provision and unless otherwise agreed, the place of performance of the obligation in question shall be:"* | (+) | COF |
| | | 5(1)(b) | *"in the case of the sale of goods, the place in a Member State where, under the contract, the goods were delivered or should have been delivered,"* | (–) | NCO |
| | | 5(1)(b) | *"in the case of the provision of services, the place in a Member State where, under the contract, the services were provided or should have been provided,"* | (+) | COF |
| | | 5(1)(c) | *"if subparagraph (b) does not apply then subparagraph (a) applies;"* | (+) | COF |
| | | 5(2)-5(4) | not cited | (–) | NCO |
| | | 5(5) | *"as regards a dispute arising out of the operations of a branch, agency or other establishment, in the courts for the place in which the branch, agency or other establishment is situated;"* | (+) | SPE |
| | | 5(6)-7 | not cited | (–) | NCO |
| | Section 4, Jurisdiction over consumer contracts | 15(1) | *"In matters relating to a contract concluded by a person, the consumer, [...], jurisdiction shall be determined by this Section, without prejudice to Article 4 and point 5 of Article 5, if:"* | (+) | CCO |
| | | 15(1) | *"[...], for a purpose which can be regarded as being outside his trade or profession, [...]"* | (+) | COF |
| | | 15(1)(a)-(b) | not cited | (–) | NCO |
| | | 15(1)(c) | *"in all other cases, the contract has been concluded with a person who pursues commercial or professional activities in the Member State of the consumer's domicile or, by any means, directs such activities to that Member State or to several States including that Member State, and the contract falls within the scope of such activities."* | (+) | CCO, COF |
| | | 15(2) | *"Where a consumer enters into a contract with a party who is not domiciled in the Member State but has a branch, agency or other establishment in one of the Member States, that party shall, in disputes arising out of the operations of the branch, agency or establishment, be deemed to be domiciled in that State."* | (+) | COF |
| | | 15(3) | not cited | (–) | NCO |
| | | 16(1) | *"A consumer may bring proceedings against the other party to a contract either in the courts of the Member State in which that party is domiciled or in the courts for the place where the consumer is domiciled."* | (+) | CCO |
| | | 16(2) | *"Proceedings may be brought against a consumer by the other party to the contract only in the courts of the Member State in which the consumer is domiciled."* | (+) | CCO |
| | | 16(3) | not cited | (–) | COC |
| | | 17 | *"The provisions of this Section may be departed from only by an agreement:"* | (+) | CCO, CHO |
| | | 17(1) | not cited | (–) | NCO |
| | | 17(2) | *"which allows the consumer to bring proceedings in courts other than those indicated in this Section; or"* | (+) | CCO, CHO |
| | | 17(3) | not cited | (–) | NCO |
| | Section 7, Prorogation of jurisdiction | 23(1) | *"If the parties, one or more of whom is domiciled in a Member State, have agreed that a court or the courts of a Member State are to have jurisdiction to settle any disputes which have arisen or which may arise in connection with a particular legal relationship, that court or those courts shall have jurisdiction. Such jurisdiction shall be exclusive unless the parties have agreed otherwise. [...]"* | (+) | CHO |
| | | 23(1)(a)-23(2) | not cited | (–) | VAL |
| | | 23(3) | *"Where such an agreement is concluded by parties, none of whom is domiciled in a Member State, the courts of other Member States shall have no jurisdiction over their disputes [...]"* | (+) | CHO |
| | | 23(3) | *"[...] unless the court or courts chosen have declined jurisdiction."* | (–) | RES |
| | | 23(4)-(5) | not cited | (–) | NCO |
| | | 24 | not cited | (–) | RES |
| Chapter V, General provisions | none given | 59 | not cited | (–) | SCO |
| | | 60(1) | *"For the purposes of this Regulation, a company or other legal person or association of natural or legal persons is domiciled at the place where it has its: (a) statutory seat, or (b) central administration, or (c) principal place of business."* | (+) | COF |
| | | 60(2) | *"For the purposes of the United Kingdom and Ireland 'statutory seat' means the registered office or, where there is no such office anywhere, the place of incorporation or, where there is no such place anywhere, the place under the law of which the formation took place."* | (+) | COF |
| | | 60(3)-62 | not cited | (–) | NCO |
| | | 63 | not cited | (–) | TRA |
| | | 64-65 | not cited | (–) | NCO |

technical specifications. Accordingly, a certain degree of interpretation due to lack of formal completeness is inherent.

In this context, the adopted two-step approach of first modeling thematic blocks, and then modeling inter-dependencies between blocks helps address challenges appropriately. In the first step, the main challenge consists in reflecting a single thematic block in a most law-abiding way. Consistency, thus, is key here. In the second step, the main challenge consists in determining a hierarchy between modeled thematic blocks and to interlink them in a way that leads to an integrated activity.

### 6.4.1 Formal and Procedural Requirements

Activity diagram models resulting from both steps have to satisfy a number of formal and procedural requirements determined:

**OMG UML compliance** — All diagrams are compliant with version 2.1.2 of the OMG UML specification for activity diagrams [69]. Activity diagrams make use of the following language elements:

**Activity** ([69], Table 12.3) — Each thematic block modeled (step 1) as well as the integrated activity diagram (step 2) constitutes an activity. Activities may contain nodes and flows (edges) as described subsequently.

**ControlFlow** ([69], Table 12.2) — Directed (arrowed) transitions constitute control flows. Control flows must connect exactly two nodes in general. Diagrams of step 1 may have control flows that connect only one node (starting point of a flow), *i.e.*, control flows may be "open-ended". Control flows of diagrams of step 2 must always connect two nodes.

**InitialNode** ([69], Table 12.1) — Each activity of step 1 disposes of exactly one initial node. This node references the start of an activity, *i.e.*, the control flow of an activity initially starts here. The same requirement applies for the integrated diagram of step 2, whereas such integrated diagram covers modeled provisions of multiple thematic blocks in a single activity and this activity disposes of exactly one initial node.

**ActivityFinal** ([69], Table 12.1) — Each activity of step 1 disposes of exactly one final node. This node references the termination of an activity. If a control flow reaches a final node, any other potentially active control flow is terminated as well. The same requirement applies to the integrated diagram of step 2 in the same way as described for initial nodes.

**Action** ([69], Table 12.1) — Actions represent those moments in an activity at which a statement about jurisdiction or applicable law is made. In order to facilitate an implementation in logic programming, statements in actions follow a regulated syntax as determined in Figure 6.1 for the case of Brussels I and the question of jurisdiction. Statements following this syntax cover three elements: First, the applicable type of jurisdiction is determined. There is not only a single type of jurisdiction, but a set of jurisdictions. Different jurisdictions may be brought into a hierarchy. For instance, special jurisdiction overrules general jurisdiction. Exclusive jurisdiction supersedes non-exclusive jurisdictions. Other PILs might know additional jurisdiction characteristics, such as unwaivable jurisdiction (*e.g.*,

relevant to consumer contracts under [19]). Second, a statement about jurisdiction is characterized with respect to dispute. This includes a differentiation of contract-related disputes and disputes that originate from operating an establishment. While the former is obviously of interest here, the latter is as well as long as the operation of an establishment happens in the context of an international service contract. Furthermore, PIL provisions typically determine jurisdiction in dependence of which contract party is claimant and which party is defendant. Consequently, this aspect is reflected in the syntax diagram of Figure 6.1. Third, the syntax presented includes the actual statement about where — in which state — and possibly by means of which connecting factor jurisdiction is attributed.
In addition to a regulated syntax, all activity diagrams of step 2 have to fulfill a requirement of central importance: Every distinct path between an initial node and a final node must pass at least once an action node. This guarantees that at least a single statement (in this context a statement about jurisdiction) is made. In order to fulfill this requirement and as an exception to the syntax diagram shown in Figure 6.1, diagrams of step 2 introduce actions that include void jurisdiction statements. These void statements are related to those "open-ended" control flows of step 1 diagrams that lead to an outcome in which the modeled PIL does not substantiate any jurisdiction/applicable law. Void jurisdiction statements are formulated as either "No jurisdiction for `<contract party>` claims by virtue of `<PIL>`" or "No jurisdiction by virtue of `<PIL>`".

**DecisionNode** ([69], Table 12.1) — Decision nodes follow a common syntax scheme similar to the syntax regulated for action nodes. Each decision node has exactly one input edge and exactly two output edges. The output edges are mutually exclusive from a control flow perspective. This means that according to the respec-

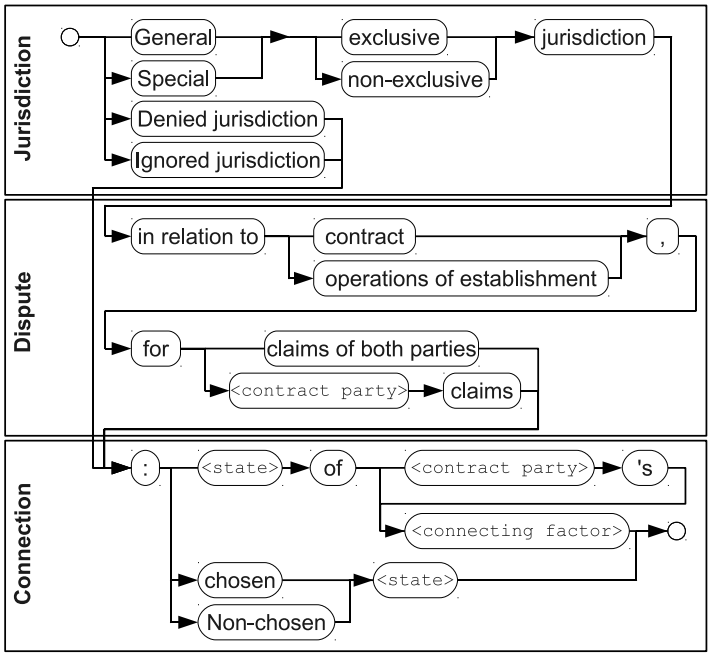


Figure 6.1: Syntax Diagram for Jurisdiction-oriented Statements in Actions Nodes

tive <<decisionInput>> statement of any given decision node (each decision node has exactly one <<decisionInput>>), control flows only along one of the two possible output edges. Output edges are always marked with yes and no, respectively. Accordingly, <<decisionInput>> statements reflect yes-no questions. These statements typically include a contract party (subject of statement), a verb, and a characteristic related to a connecting factor.

**ForkNode, JoinNode, MergeNode** ([69], Table 12.1) — A fork node has exactly one input edge and multiple (two to many) output edges. It multiplies any incoming control flow by as many output edges it has. This means that control flow tokens run in parallel on different paths. A fork node is complemented by its counterpart, a join node. Join nodes have multiple (two to many) input edges and exactly one output edge. Join nodes synchronize previously multiplied control flows. A join nodes outputs a single control flow if and only if all incoming control flow tokens have arrived. For every parallelization opened by a fork node (in diagrams of both steps), there must be a join node integrating parallel flows into a single flow synchronously. Merge nodes, finally, are similar to join nodes in behavior, but they are asynchronous. This means that a control flow is outputted every time a single input edge delivers an incoming control flow to the merge node irrespective of whether other incoming edges have delivered control flow tokens or not. As such, activity diagrams modeled make use of merge nodes in order to integrate mutually exclusive control flow paths opened by decision nodes.

**Connector** ([69], Figure 12.40) — When integrating modeled thematic blocks into a single consistent activity diagram (step 2) the use of connectors helps keep the resulting diagram remaining visually clear. Connectors are used to bridge visually control flows. Functionally, however, connectors do not have any meaning and, thus, they do not find representation in the implementation. Connectors consist of a circle-shaped node denoted by a character. A single connector is found always twice in a diagram. Once as an end node of a control flow to be bridged, once as the respective starting node of the same control flow.

**Identifier** — Each control flow, <<decisionInput>>, and action in the activity diagrams modeled in both steps must have a unique identifier. This identifier consists of one character and a number. Numbers must be unique per character used. A character is typically used per thematic block modeled (step 1). The identifier has no deeper meaning beyond referencing items of an activity diagram in an unambiguous way. In the implementation, identifiers are used to represent predicates reflecting partial paths. Identifiers are placed before any statement and separated from the statement by means of a colon. Identifiers determine a feature added on top of the UML 2 activity diagram specification.

**Reference** — Similar to identifiers, each <<decisionInput>> and each action in the activity diagrams modeled in both steps must have at least one reference to the respective modeled provision(s) of the PIL in question. For Brussels I, references reflect articles. A reference is placed after a statement. It is embraced by brackets. In case of void jurisdiction/applicable law statements “n/a” is used instead of a reference. Multiple references are comma-separated. References serve as assistance to track back a

statement to the law modeled. References are not used in the implementation. References are a feature added on top of the UML 2 activity diagram specification.

**Dotted control flows** — As described previously, diagrams resulting from modeling step 1 may be "open-ended", diagrams of step 2 must be fully integrated so that control flows cannot end in an undetermined manner. Integration bears a high amount of complexity due to an inherent degree of freedom in modeling and inter-relating thematic blocks. In order to express this openness explicitly, diagrams make use of dotted control flow representations whenever a transition is not substantiated directly and only by the respective law provisions modeled. Dotted control flows, thus, mark transitions which incorporate a higher degree of interpretation. This is a feature added on top of the UML 2 activity diagram specification.

### 6.4.2 Activity Diagrams per Thematic Block of Brussels I

In accordance with those requirements determined and listed, Figures 6.2, 6.3, 6.4, and 6.5 show the respective activity diagrams modeled for step 1. These figures, thus, cover four thematic blocks as identified in Section 6.3. Figure 6.2 covers provisions in relation to consumer contracts (*cf.* provisions marked with CCO in Table 6.3. Figure 6.3 covers provisions of choice of jurisdiction (CHO), while Figure 6.4 is about special jurisdiction (SPE), and Figure 6.5 models general jurisdiction provisions (GEN).

Each of these diagrams reflects a similar structuring approach. In the first decision nodes included after the initial node, fundamental pre-conditions for a thematic block to apply are modeled. For instance, the respective detailed provisions for consumer contracts apply only if a service customer is a consumer (c2 in Figure 6.2), if that service customer has domicile in a member state of Brussels I (c5), and if the service provider in question targets the state in which the service customer is domiciled (c8). For the case of choice of jurisdiction, the respective pre-condition is found in that at least one contract party has domicile in a Brussels I member state (p2 and p4 in Figure 6.3 including the according case separation in p9, p15, p20 and p10, p16, p21, respectively).

For special and general jurisdiction, finally, pre-conditions are the same, namely whether a contract party has domicile in a Brussels I member state (s1, s3 in Figure 6.4 and g1, g3 in Figure 6.5). The specific way these pre-conditions have been modeled here is reasoned by the needed time-wise porting of Brussels I provisions back to the moment of contract conclusion. Brussels I differentiates jurisdiction according to which contract party is defendant and claimant in a dispute brought to court. It assumes the existence of a concluded contract and that a dispute has arisen and that a claim was deposited in a court. This is the case for most provisions modeled in relation to consumer contracts, special jurisdiction, and general jurisdiction. It is, however, not the case for choice of jurisdiction provisions. There, Brussels I attributes jurisdiction for (potential future) claims of both parties to the courts of the respective agreed and chosen state. For all other jurisdiction attributions, however, jurisdiction is assigned for the claims of a single contract party only.

Since this work looks at determining recommendable jurisdiction(s) and applicable law(s) at the time of contract conclusion, all provisions assuming a dispute in court have to be ported. In particular, this means that for the time of contract formation an equivalent to roles of a claimant and defendant needs to be found. This is achieved by means of a case differ-

entiation introduced in Figures 6.4 and 6.5. This case differentiation leads to parallelization. In the first case, jurisdiction is determined according to the case that a service provider has domicile in a Brussels I member state. In the second case, the same is done for the case that a service customer has domicile in a Brussels I member state.

Of course, any specific modeling decision taken and described so far is valid for the investigated example PIL only. Nevertheless, from a methodological point of view, the introduced way to handle pre-conditions and a time-wise back-porting by means of a case differentiation constitute procedures of general validity. In addition to these general aspects, the set of Brussels I-specific connecting factors becomes apparent at this step of modeling. Connecting factors are represented in decision and action nodes. Domicile and consumer status have been mentioned already for several occasions, but there are multiple connecting factors more to be considered. A service provider's market activities (c8 in Figure 6.2), a

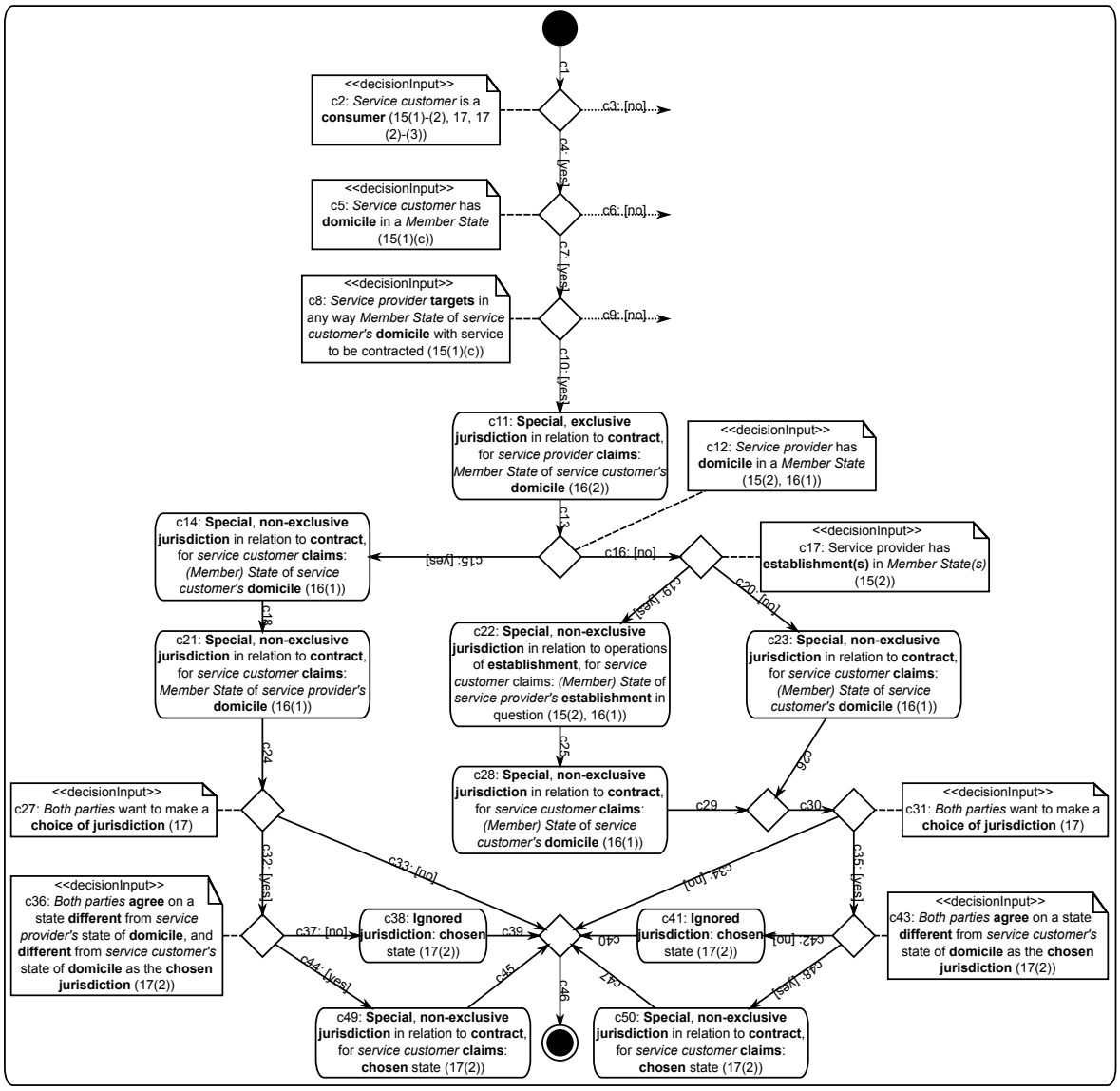


Figure 6.2: Activity Diagram for Brussels I Consumer Contract Provisions

service provider's establishments (c17, c22; s10, s22 in Figure 6.4), location of performance for a service (s8, s21, s12, s23), and choice of jurisdiction-related factors (most nodes in Figure 6.3; c27, c31, c36, c38, c41, c49, c50 in Figure 6.2) denote the most important additional connecting factor dimensions for Brussels I. These factors are of key importance to the respective information model as discussed in in Chapter 5.

### 6.4.3 Integrated Activity Diagram for Brussels I

As the main goal in activity diagram modeling is in an integrated functional model (modeling step 2), these four thematic blocks modeled previously need to be brought into a single con-

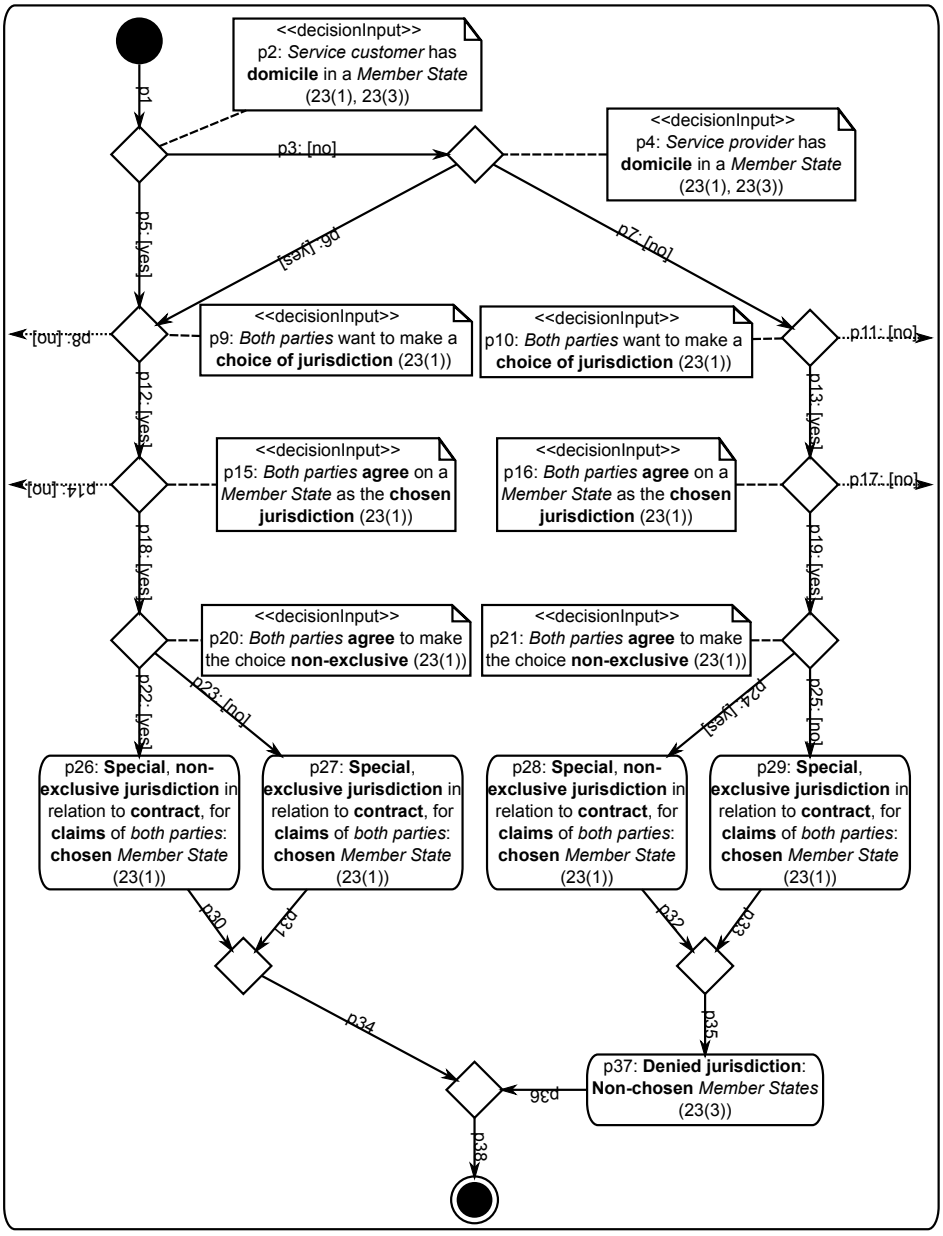


Figure 6.3: Activity Diagram for Brussels I Choice of Jurisdiction Provisions

sistent, Brussels I-compliant activity diagram. The resulting integrated viewpoint is shown in Figure 6.6. In order to visualize changes made, added nodes are marked with a gray background. Those different steps needed to integrate models of Figure 6.6 into the activity diagram of Figure 6.6 are explained subsequently.

The most important question in integrating thematic blocks is about hierarchical interrelations between blocks. For a law such as the investigated Brussels I, a reasonable approach to hierarchy is to separate according to the dimension of specificity. Brussels I knows provisions about general jurisdiction. General jurisdiction applies if there is not a more specific provision to apply. In other words, the more specific a provision is the higher this provision is ranked. Following this principle, provisions of general jurisdiction (Figure 6.5) are ranked lowest. Next in hierarchy are provisions of special jurisdiction (Figure 6.4), meaning special jurisdiction supersedes general jurisdiction. Provisions in relation to consumer contracts (Figure 6.2) and to choice of jurisdiction (Figure 6.3) rank on the top-most hierarchy level as those provisions may be seen as special cases of special jurisdiction. This hierarchy is, in principle, in-line with the hierarchy determined in [90]:

> *"[...] have a particular hierarchical structure, which are determined by the following criteria:*
> *1. Does the matter relate to an exclusive jurisdiction ground?*
> *2. Has there been a tacit prorogation of the court according to Article 24?*
> *3. Does the claim concern a protective jurisdiction rule?*
> *4. Did the parties agree upon a court in particular as stipulated in Article 23?*
> *5. Does the claim arise out of an action for which alternative jurisdiction rules*

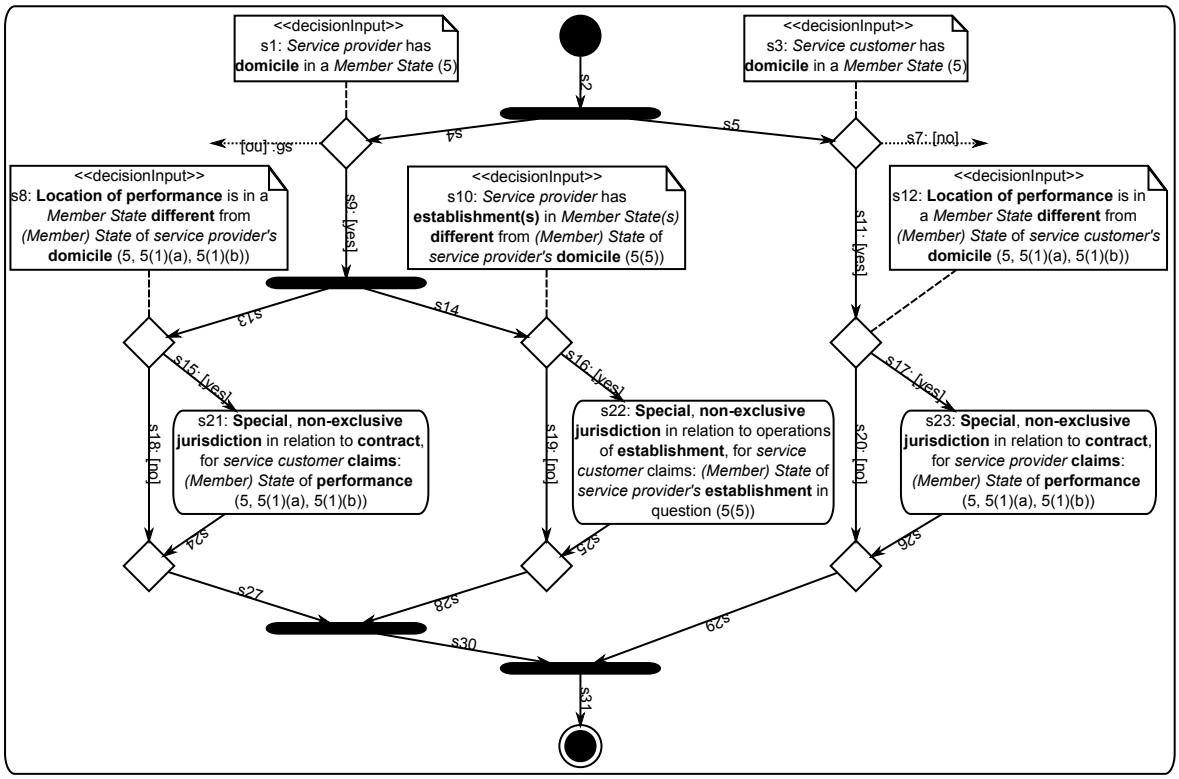


Figure 6.4: Activity Diagram for Brussels I Special Jurisdiction Provisions

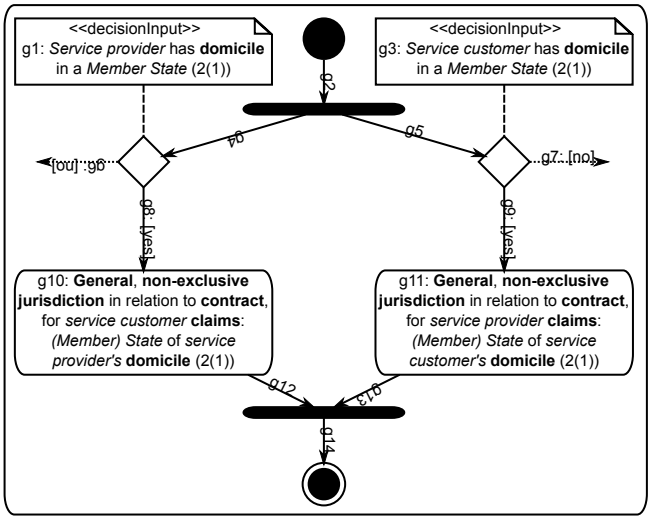


Figure 6.5: Activity Diagram for Brussels I General Jurisdiction Provisions

*provide for a forum that is different from the forum indicated in Article 2?*
*6. If the claim concerns a provisional protective matter, [...].”*

Out of this hierarchy list, criteria 2) and 6) are not relevant here. The latter is not considered as provisional matters are excluded (see Table 6.1). The former is not considered as Article 24 is excluded (see Table 6.3). As with respect to criterion 1), exclusive jurisdiction — which is assigned highest priority — is attributed in Figure 6.2 (c11) and Figure 6.3 (p27, p29). Accordingly, highest priority is assigned to consumer contract-related and to choice of jurisdiction-related provisions. For consumer contract provisions, additional importance is attributed by criterion 3), whereas choice of jurisdiction earns somewhat less weight by criterion 4). Criterion 5), finally, addresses hierarchical issues between special and general jurisdiction: Special jurisdiction gains preference over general jurisdiction. In consequence, the applicable hierarchy of modeled thematic blocks (using mnemonics of Table 6.1) is substantiated as follows:

**Top priority** — CCO and CHO, whereas CCO is slightly preferred over CHO

**Middle priority** — SPE

**Lowest priority** — GEN

This hierarchy is reflected by Figure 6.4.3. The integrated activity diagram checks first if pre-conditions for CCO are given. If yes, jurisdiction in relation to consumer contracts is determined and the activity is terminated eventually. If CCO does not apply, then CHO is checked next. Again, if choice of jurisdiction pre-conditions apply, jurisdiction is determined accordingly, and the overall activity is terminated eventually. If parties, however do not want to make a choice of jurisdiction or if they cannot agree on a choice, pre-conditions of SPE are checked, applied if applicable, and finally general jurisdiction is determined, whereupon the overall activity is terminated.

In reversed order of hierarchy, the integration of thematic blocks into a single activity diagram was performed as follows: First of all, GEN (Figure 6.5) and SPE (Figure 6.4)

were integrated. This is a straight forward task as these two blocks share the same pre-conditions and, thus, are structured equally. Therefore, action nodes g10 and g11 were moved to control flows s30 and s29, respectively. The terminal node connected to s31 was replaced by a connector (A) to c45 and, by that, to the remaining, single terminal node. For the two "open-ended" control flows of s6 and s7, void jurisdiction statements in two new action nodes (s34 and s36) were added and connected via s35 and s37 through connectors E and F to the activity's terminal node. Finally, the initial node of Figure 6.4 was replaced by connector B coming from a newly introduced control flow p39 out of CHO (Figure 6.3).

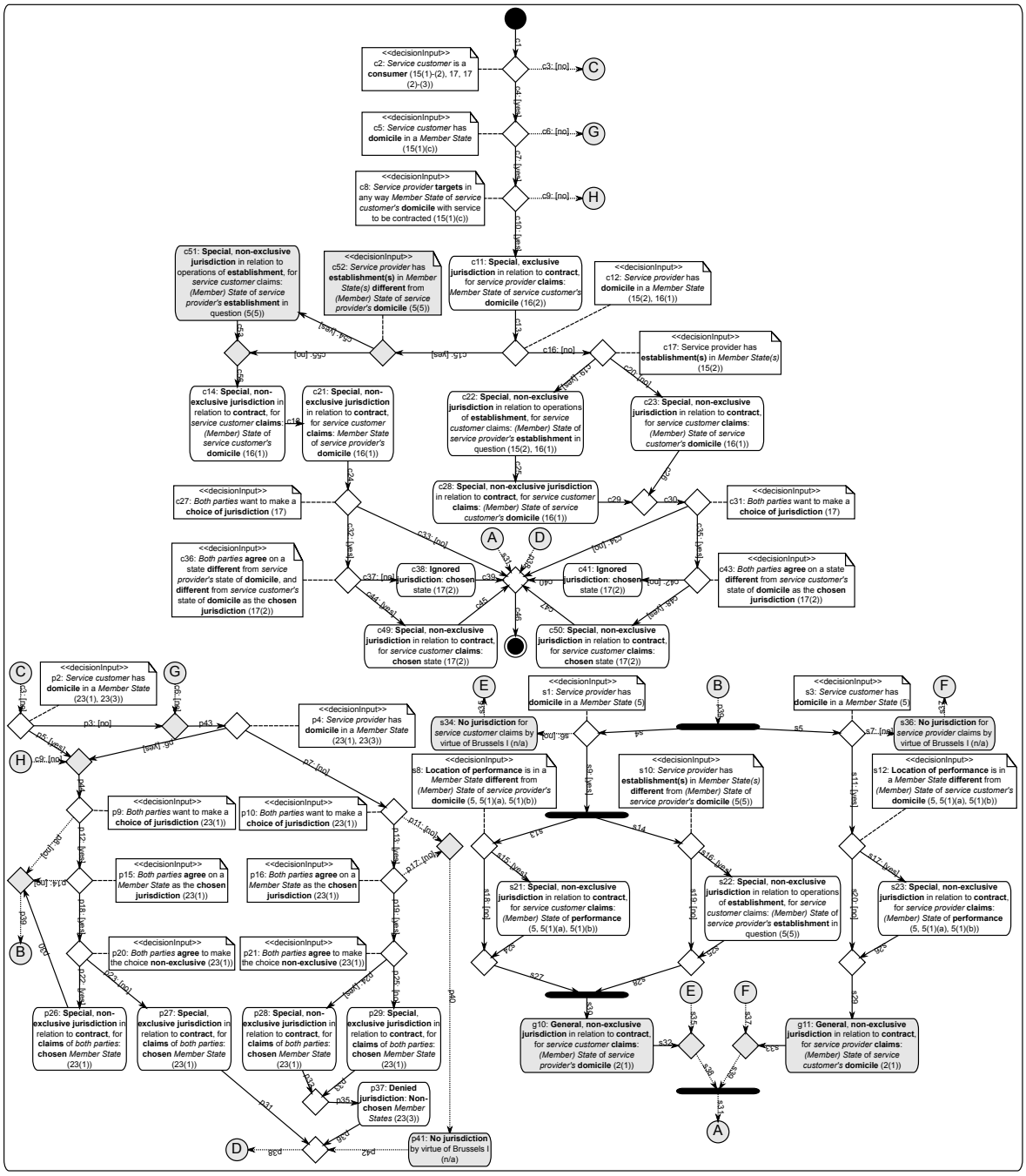


Figure 6.6: Integrated Activity Diagram (Modeling Step 2)

Connector B, control flow p39 as well as a related merge node were added to address "open-ended" control flows of p8 and p14. These edges indicate situations in which pre-conditions for CHO are given, but contract parties either do not want to prorogate jurisdiction or they cannot agree on a choice. Figure 6.3 knows two other control flows which are "open-ended", namely p11 and p17. For these cases, in which neither of the involved contract parties has domicile in a Brussels I member state and in which parties do not want to make a choice or they cannot find an agreement, a merge node, control flow p40, void jurisdiction statement p41, and control flow p42 were added. It would not make sense to lead control via connector B to SPE and GEN in this case, since pre-conditions for neither SPE nor GEN would be given. Hence the void jurisdiction statement and the subsequent activity termination (through connector D which replaces the former terminal node of Figure 6.3).

Newly added entry points for CHO are denoted by connectors C, G, and H. C replaces the former initial node. It connects from CCO via c3, implying that the contractual relationship considered is not a B2C, but a B2B one. G connects via c6 assuming that the involved service customer does not have domicile in a Brussels I member state. H connects via c9 which means that the involved service customer has domicile in a member state, but the involved service provider does not target that member state in any way. G and H both imply that the service customer in question is a consumer, thus, a B2C relationship is implied. Nevertheless, and while CCO provisions cannot apply as explained, control flow is handed over to CHO (and with that potentially to SPE and GEN) which might still apply. At this point, it becomes fully clear that integrating thematic blocks into a single activity is a highly complex task — and a task which requires a certain degree of interpretation even though the hierarchy between thematic blocks might seem clarified in general.

Similar considerations hold true for a final integration change made involving CCO (Figure 6.2) and SPE (Figure 6.4): In case pre-conditions for CCO are all fulfilled and the service provider in question has domicile in a Brussels I member state (c12, c15), jurisdiction statements in relation to contract would be made in action nodes c14, c21, and either c38 or c49 before the overall activity would be terminated. This would imply special jurisdiction in relation to operations of establishment (s22) would never be made. This is why decision node s10 and action node s22 were copied and inserted between control flow c15 and action node c14. Further copying is not needed as, on the one hand, the respective pre-conditions for application are not given in case of c16, while on the other hand, by means of connectors B, C, G, and H it is guaranteed that s22 is reachable in all relevant cases.

## 6.5 Modeling Method Summary

This chapter has contributed extensively in several dimensions to develop and document an appropriate modeling method. This method is in all sub-steps — those of PIL identification and selection, PIL analysis, and activity diagram modeling — accompanied by application to the concrete example of the Brussels I regulation.

In PIL identification and selection, sources for law identification are determined to include law compilations, court decisions, books, articles, commentaries and specialized web sites. In order to select a PIL identified, the respective set of selection criteria has to be met. A PIL in question may be selected if it applies to the provision of services and to civil and commercial matters, if it makes connection to more than one jurisdiction, if it applies

to relations with international connection, and if geographical, time-wise, and hierarchical application is given.

In PIL analysis, a list of specific in- and exclusion criteria is to be respected. These criteria find application when a selected law is assessed in a two-step procedure — first a high-level pre-selection on section level, then a detailed provision-by-provision selection. In activity diagram modeling, finally, detailed instructions with respect to formal requirements on activity diagrams are provided. These embrace UML activity diagram standard compliance in the sense that all used model elements are listed including specific requirements like the number of incoming and outgoing control flows.

Driven by these requirements and in accordance with the action node syntax specification outlined, Brussels I has been modeled in a two-step procedure. First, thematic blocks in the law have been identified as to cover consumer contracts, choice of jurisdiction, special jurisdiction, and general jurisdiction. These thematic blocks are modeled as single activity diagrams. Subsequent to this, thematic blocks have been brought into a hierarchy and integrated into a single, consistent activity diagram (*cf.* Figure 6.6).

In conclusion, the resulting integrated activity diagram constitutes the fourth key contribution of this thesis for the specific example PIL of Brussels I considered here. While the modeling methodology developed and documented represents the third main contribution, the integrated activity diagram is the direct result of this methodology. It proves that a formal modeling according to the methodology introduced is feasible and and that this leads to the desired result. That is to say the resulting activity diagram determines fundamental input to the subsequent implementation addressed in Chapter 7.

# Chapter 7

# DeRISC Design and Implementation

The fourth major contribution in this thesis consists in a decision support system – named DeRISC (Dispute rEsolution Recommender for International Service Contracts) — to determine recommendations in relation to a service contract to be concluded. This chapter focuses on the design and a prototype implementation of DeRISC. Subsequent to an outline of fundamental system design decisions taken, diverse implementation aspects are depicted.

The implementation is detailed with regard to a partial path approach adopted as the main means to cope with complexity and to allow for code re-use. This is followed by an in-depth presentation of connecting factors considered and the actual predicates that implement partial and full paths of a previously modeled activity diagram. Connecting factors and predicates provide both the relevant basis for a subsequent functional evaluation of the DeRISC prototype implemented. Finally, results obtained are valued in terms of contributions made, decision support requirements met, feasibility shown, and functionality assessed.

These implementation aspects are in all steps substantiated by the specific DeRISC prototype implementation reflecting an exemplary PIL, the Brussels I regulation. Consequently, the prototype implementation reflects a machine-executable representation — in terms of a rule-based system — of the activity diagram determined for Brussels I, taking into consideration the respective concepts and artifacts of relevance as determined in the information model.

## 7.1 Implementation System Design

From a design viewpoint, the DeRISC implementation constitutes a rule-based system. It embraces a knowledge base and an inference engine. The knowledge base consists of rules and facts. The inference machine determines under which circumstances a rule is applied, what facts it considers in rule application, and what facts are affected by a rule applied. The rule-based system follows a traditional input-processing-output model as shown in Figure 7.1.

The processing part relates to the inference machine as it is concerned with decision making. Decision making is facilitated by using the Prolog programming language following the logic programming paradigm. Logic programming funds on principles of mathematical logic. Based on a set of facts and rules, solutions to a query may be found following mathe-

matical logic. In the context of DeRISC, solutions relate to statements about recommended jurisdictions according to a previously modeled law.

Prolog, which is a widely used language in logic programming, helps declare facts and rules based on which the logic reasoning is performed. Rules are expressed as logic implications. Since any law that was modeled using the presented modeling method is reflected by a resulting activity diagram, and since such an activity diagram is designed to consist of implications (in terms of `if <condition(s)>, then <action(s)>`), the use of a logic programming language and the implementation of DeRISC as a rule-based system become beneficial.

Accordingly, the inference machine is referred to as Prolog decision engine in Figure 7.1. As Prolog implementation, SWI-Prolog [85] in version 5.8.0 with multi-thread support compiled for 32-bit Linux systems is used. SWI-Prolog is an established, stable Prolog implementation compatible with both, the ISO Prolog standard (part 1) [51] and the Edinburgh Prolog [22] dialect. SWI-Prolog is free software with its kernel being licensed under the terms of the GNU Lesser General Public License (LGPL).

Input to the Prolog decision engine is of two types: predetermined and interactive. The latter relates to jurisdiction queries. The former constitutes the logic of a previously modeled activity diagram (rules) and the set of connecting factor variations (facts). In the case of the DeRISC prototype implemented, the activity diagram for Brussels I and the respective connecting factors are considered. Both, rules and facts, are expressed as logic predicates in Prolog notation. A specific connecting factor variation and the respective path through the relevant activity diagram reflect a single test case to assess the implementation's functionality. The output of the decision engine is a set of jurisdiction recommendations determined by the Prolog interpreter applying rules and facts in relation to individual service contracts.

The same system design is applicable to all PILs that have been modeled as activity diagrams according to the developed PIL modeling method. For each modeled PIL, a dedicated set of rules and facts is established. The way that single rules are implemented (by partial path implications) as well as the interaction mode (input-processing-output), however, remain the same for different PILs being implemented. The European case of the Brussels I implementation, hence, serves as a reference implementation. The same system design and implementation approach can be followed when additional PILs will be implemented. This PIL-by-PIL implementation approach — following the same system design, resulting in a PIL-specific implementation in terms of rule and fact predicates — is fully in-line with the overall three-step procedure introduced in Figure 3.3. A single system implementation, such as the exemplary case of the Brussels I implementation shown here, reflects a PIL-specific implementation and output as shown in step 2 of Figure 3.3.

Accordingly, Section 7.2 details on a splitting into partial path implications. Section 7.3 focuses on connecting factor variations, while Section 7.4 presents those Prolog predicates that specify decision rules for partial and complete paths in the Brussels I activity diagram, and Section 7.5 documents jurisdiction queries and functional verification.

## 7.2 Partial Path Implications

The prototype implementation of DeRISC reflects the previously modeled activity diagram for Brussels I (*cf.* Figure 6.6). This means that the logic of the Brussels I activity diagram

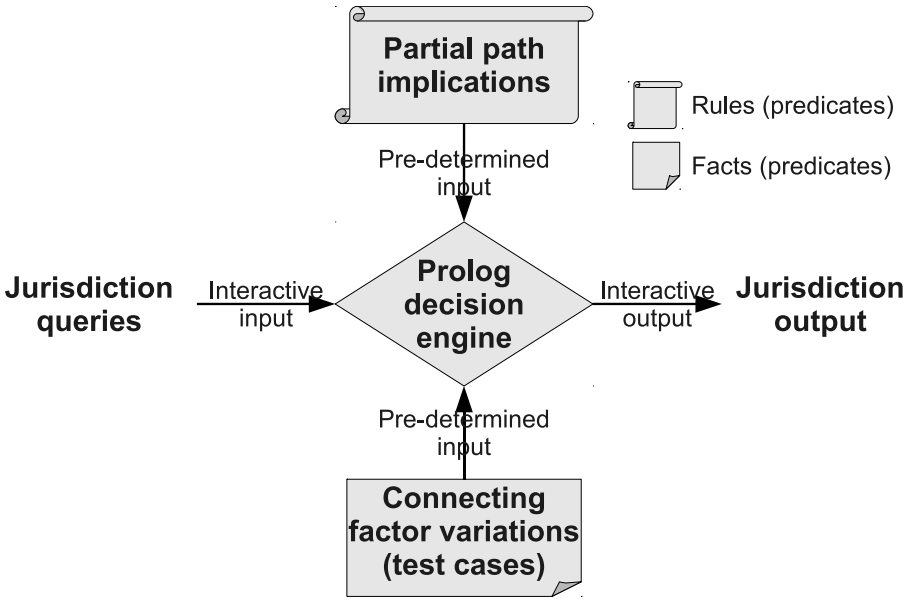


Figure 7.1: System Design Outline

needs to be translated into machine-executable representation. Logic in this context refers to those many `if <condition(s)>, then <action(s)>` cases modeled in the activity diagram. Machine-executable representation in this context refers to rules and facts expressed as predicates in Prolog notation.

A complete, dedicated path from the initial to the terminal node of the Brussels I activity diagram covers multiple `if <condition(s)>, then <action(s)>` cases. A complete path also constitutes a single test case as expressed by means of a given connecting factor variation. A possible implementation approach, thus, would be to directly reflect complete paths, *i.e.*, to implement a single predicate for a complete path. Since the Brussels I activity diagram, however, shows a quite complex activity, the number of complete paths to be modeled in such an approach would be considerably large. Furthermore, several complete paths would have substantial overlaps as they would differ in a few decisions only. The implementation would consist largely of very lengthy predicates for complete paths that would be difficult to debug and that would share large code parts with other path predicates. For these reasons, a more structured implementation approach was chosen. Its main idea consists in complexity reduction and code re-use by means of splitting the Brussels I activity diagram into partial paths.

For each partial path, the implementation specifies a rule expressed as logic predicate in Prolog notation. It is important to note that these predicates are logic implications. This due to the way, the activity diagram to be implemented is split into partial paths. The procedure to identify partial paths starts at an activity diagram's terminal node. Starting from the terminal node, logic implications about preceding partial paths through the activity diagram of interest are made.

For the specific example of the Brussels I activity diagram, this means that, when starting from the activity diagram's terminal node and then going backwards, the first partial path definition is the one for control flow c46 in Figure 6.6. If c46 was taken, this implies that c45, c39, c33, s31, p38, c34, c40, or c47 was taken before. Similarly, c45 implies c49, c44,

and c32, while c39 implies c38, c37, and c32. So, the next step in partial path definition is to determine implications of c32 and so on. This partial path implication procedure is repeated until all control flows are fully determined as being part of a partial path. Table 7.1 documents the resulting partial paths determined and expressed in terms of implications. In accordance with Prolog syntax, ";" stands for a logic OR connection and "," stands for a logic AND connection.

Table 7.1: Partial Paths for Brussels I Expressed as Implications

| Path | Implied partial path |
|---|---|
| **c46** | c45; c39; c33; s31; p38; c34; c40; c47 |
| **c45** | c49, c44, c32 |
| **c32** | c24 |
| **c24** | c21, c18, c14, c56 |
| **c56** | c53; c55 |
| **c53** | c51, c54, c15 |
| **c15** | c13 |
| **c13** | c11, c10, c7 |
| **c7** | c4 |
| **c4** | c1 |
| **c55** | c15 |
| **c39** | c38, c37, c32 |
| **c33** | c24 |
| **s31** | s38, s39 |
| **s38** | s32; s35 |
| **s32** | g10, s30 |
| **s30** | s27, s28 |
| **s27** | s18; s24 |
| **s18** | s13, s9 |
| **s9** | s4 |
| **s4** | p39 |
| **p39** | p8; p14; p30 |
| **p8** | p44 |
| **p44** | c9; p5; p6 |
| **c9** | c7 |
| **p5** | c3 |
| **c3** | c1 |
| **p6** | p43 |
| **p43** | p3; c6 |
| **p3** | c3 |
| **c6** | c4 |
| **p14** | p12 |
| **p12** | p44 |
| **p30** | p26, p22, p18 |
| **p18** | p12 |

| Path | Implied partial path |
|---|---|
| **s24** | s21, s13, s9 |
| **s28** | s19; s25 |
| **s19** | s14 |
| **s14** | s9 |
| **s25** | s22, s16, s14 |
| **s35** | s34, s6, s4 |
| **s39** | s37; s33 |
| **s37** | s36, s7, s5 |
| **s5** | p39 |
| **s33** | g11, s29 |
| **s29** | s20; s26 |
| **s20** | s11 |
| **s11** | s5 |
| **s26** | s23, s17, s11 |
| **p38** | p31; p36; p42 |
| **p31** | p27, p23, p18 |
| **p36** | p37, p35 |
| **p35** | p32; p33 |
| **p32** | p28, p24, p19 |
| **p19** | p13 |
| **p13** | p7 |
| **p7** | p43 |
| **p33** | p29, p25, p19 |
| **p42** | p41, p40 |
| **p40** | p17; p11 |
| **p17** | p13 |
| **p11** | p7 |
| **c34** | c30 |
| **c30** | c29; c26 |
| **c29** | c28, c25, c22, c19, c16 |
| **c16** | c13 |
| **c26** | c23, c20, c16 |
| **c40** | c41, c42, c35 |
| **c35** | c30 |
| **c47** | c50, c48, c35 |

By following strict logic, any partial path in relation to a merge node would have to make use of a logic XOR operation (exclusive OR) instead of logic OR. However, by virtue of those formal activity diagram modeling requirements raised in Section 6.4, activity diagrams guarantee that only one input edge carries a control flow token into a merge node. Consequently, logic OR can be used instead of the more complex logic XOR.

In a next step, these partial paths identified are directly implemented as Prolog predicates. Each predicate constitutes a rule expressed as an implication. Before defining this set of

rules, however, it is necessary to identify the parameters that need to be considered when making a decision by one of the rules. These parameters are connecting factors (*cf.* Figure 7.1) as determined subsequently.

## 7.3 Connecting Factor Variations

Connecting factors are reflected in the Prolog implementation by means of predicates representing facts. Each connecting factor predicate is supposed to make a statement about all facts necessary to make decisions. This implies that decision-relevant connecting factors need to be collected first. By going through the modeled Brussels I activity diagram of Figure 6.6 the set of 12 connecting factors is identified. Accordingly, the implementation defines a connecting factor predicate `input/13`. This predicate includes 13 variables — one for an identifier, 12 for connecting factors —, each of which can be assigned with a valid value. These variables are included in accordance with the information model specified in Chapter 5, and in particular with respect to the information artifacts described. The following list defines these variables along with the respective values that can be assigned to them.

**ID** — ID is a unique number, a positive integer, serving as an identifier for a connecting factor variation.

**CustomerDomicile** — ISO three-character, non-capitalized country code for the state in which a service customer has domicile.

**ProviderDomicile** — *Cf.* `CustomerDomicile`.

**CustomerConsumer** — Either a value of "consumer" or a value of "professional". The first means that a service customer is a consumer. This would imply a B2C case–a service provider is always assumed to be a professional/business.

**CustomerChoice** — Either a value of "choice" or a value of "noChoice". The first means that a service customer wants to make a choice of jurisdiction.

**CustomerExclusiveChoice** — This variable is only considered if `CustomerChoice` is "choice". Otherwise `CustomerExclusiveChoice` will see a value of "n/a". If choice, then `CustomerExclusiveChoice` can have a value of either "exclusive" or "nonExclusive". The first means that a service customer wants to make a choice of jurisdiction an exclusive one.

**CustomerPreferred** — A list of ISO three-character, non-capitalized country codes determining a service customer's preferred states to attribute jurisdiction to. For instance, a list of [che, deu, fra] means that the service customer gives highest jurisdiction preference to Switzerland, followed by Germany, and then France. This is only considered if `CustomerChoice` has a value of "choice". Otherwise, CustomerPreferred sees an empty list ("[]").

**ProviderChoice** — *Cf.* `CustomerChoice`.

**ProviderExclusiveChoice** — *Cf.* `CustomerExclusiveChoice`.

**ProviderPreferred** — *Cf.* `CustomerPreferred`.

**ProviderEstablishments** — A list of ISO three-character, non-capitalized country codes determining states in which a service provider has establishments.

**ProviderTargetStates** — A list of ISO three-character, non-capitalized country codes determining states that a service provider targets with his service offerings.

**LocationOfPerformance** — ISO three-character, non-capitalized country code for the state in which a service is supposed to be performed.

By means of value variations in `input/13`, a data base of test cases is built. For instance, "input(15, aut, aut, professional, choice, exclusive, [aut, deu, che], choice, exclusive, [aut, cze, hun], [aut, cze, hun, svk, svn], [aut, cze, hun, svk, svn], aut)" stands for a complete path through the Brussels I activity diagram starting at c1, then leading through c3, p5, p44, p12, p18, p23, p27, p31, p38, and finally c46. This full path, thus, stands for a B2B case in which both parties have domicile in a Brussels I member state, both parties want to make an exclusive choice of law, and in which both parties agree to attribute jurisdiction to a Brussels I member state. In this case, a single action is performed (p27) in which a statement about jurisdiction is made. A specific connecting factor variation determining a full path — in other words, a given `input/13` predicate containing valid facts — constitutes a test case, since it defines an expected outcome. In the example case mentioned before, the expected outcome is that by action p27 special, exclusive jurisdiction in relation to contract and for claims of both parties is in Austria, the state mutually agreed through choice of jurisdiction.

Table 7.2 lists a selection of 19 test cases with the corresponding complete paths through the Brussels I activity diagram modeled. The test cases are represented as variations of input variables (connecting factors) to the `input/13` predicate and serve as a basis for the functional evaluation of partial and complete paths as discussed subsequently. This selection of test cases ensures that each transition, decision node, and action node (marked in bold face in Table 7.2) is covered at least[1] once.

## 7.4 Predicates Implementing Partial and Complete Paths

The main part of the implementation consists of the actual predicates for partial paths as listed in Section 7.2. These predicates are implemented as Prolog rule predicates determining logic implications (*cf.* Figure 7.1). The primary predicate is `jurisdictions/16` which reflects c46. As c46 is the last edge before the terminal node is reached, `jurisdictions /16`, is the predicate to assess overall functionality. For its special impact, the predicate was not simply named c46 but it was given more visibility by the name of "jurisdictions". All other predicates in this implementation part are named as mentioned in the partial path description.

As partial paths may include both decisions (decision nodes and the according output edges) and statements about jurisdiction (action nodes), predicates may consider input and

[1]Test cases 12 and 13 represent the same full path taken, but with differing connecting factor settings. Test case 14 would not be required to ensure the "at least once" requirement as it is covered by the combination of test cases 7 and 11.

Table 7.2: Selection of Test Cases with Corresponding Complete Paths

| ID | Test case (`input/13`) | Complete path (action nodes In bold face) |
|---|---|---|
| **1** | input(1, aut, aut, professional, choice, nonExclusive, [aut, deu, che], choice, nonExclusive, [aut, cze, hun], [aut, cze, hun, svk, svn], [aut, cze, hun, svk, svn], aut). | c1, c3, p5, p44, p12, p18, p22, **p26**, p30, p39, in parallel: (s4, s9, in parallel: (s13, s18, s27) and (s14, s16, **s22**, s25, s28), s30, **g10**, s32, s38) and (s5, s11, s20, s29, **g11**, s33, s39), s31, c46 |
| **2** | input(2, svk, aut, consumer, choice, nonExclusive, [aut, deu, che], choice, nonExclusive, [aut, cze, hun], [aut, cze, hun, svk, svn], [aut, cze, hun, svk, svn], svk). | c1, c4, c7, c10, **c11**, c13, c15, c54, **c51**, c53, c56, **c14**, c18, **c21**, c24, c32, c37, **c38**, c39, c46 |
| **3** | input(3, svk, aut, consumer, noChoice, n/a, [], choice, nonExclusive, [aut, cze, hun], [aut], [aut, cze, hun, svn], svk). | c1, c4, c7, c9, p44, p8, p39, in parallel: (s4, s9, in parallel: (s13, s15, **s21**, s24, s27) and (s14, s19, s28), s30, **g10**, s32, s38) and (s5, s11, s20, s29, **g11**, s33, s39), s31, c46 |
| **4** | input(4, svk, aut, consumer, choice, nonExclusive, [hun, deu, che], choice, nonExclusive, [aut, cze, hun], [aut, nor, lie, svk, svn], [aut, cze, hun, svk, svn], svk). | c1, c4, c7, c10, **c11**, c13, c15, c54, **c51**, c53, c56, **c14**, c18, **c21**, c24, c32, c44, **c49**, c45, c46 |
| **5** | input(5, svk, aut, consumer, choice, nonExclusive, [fra, deu, ita], choice, nonExclusive, [aut, ita, hun], [aut, nor, lie, che], [aut, cze, hun, svk, svn], svk). | c1, c4, c7, c10, **c11**, c15, c55, c56, **c14**, c18, **c21**, c24, c32, c44, **c49**, c45, c46 |
| **6** | input(6, aut, nor, consumer, choice, nonExclusive, [aut, deu, che], choice, nonExclusive, [nor, dnk, swe], [nor, dnk], [aut, bel, bgr, cyp, cze, dnk, est, fin, fra, deu, grc, hun, irl, ita, lva, ltu, lux, mlt, nld, pol, prt, rou, svk, svn, esp, swe, gbr, nor, isl, che, lie], aut). | c1, c4, c7, c10, **c11**, c16, c19, **c22**, c25, **c28**, c29, c30, c35, c42, **c41**, c40, c46 |
| **7** | input(7, isl, nor, consumer, choice, nonExclusive, [aut, deu, che], choice, exclusive, [deu, dnk, swe], [nor, dnk], [aut, bel, bgr, cyp, cze, dnk, est, fin, fra, deu, grc, hun, irl, ita, lva, ltu, lux, mlt, nld, pol, prt, rou, svk, svn, esp, swe, gbr, nor, isl, che, lie], isl). | c1, c4, c6, p43, p7, p13, p19, p25, **p29**, p33, p35, **p37**, p36, p38, c46 |
| **8** | input(8, aut, aut, consumer, choice, nonExclusive, [aut, deu, che], noChoice, n/a, [], [aut, cze, hun, svk, svn], [aut, cze, hun, svk, svn], aut). | c1, c4, c7, c10, **c11**, c15, c54, **c51**, c53, c56, **c14**, c18, **c21**, c24, c33, c46 |
| **9** | input(9, lie, aut, professional, choice, nonExclusive, [aut, deu, che], choice, nonExclusive, [svn, cze, hun], [aut, cze, hun, svk, svn], [aut, cze, hun, svk, svn], lie). | c1, c3, p3, p43, p6, p44, p12, p14, p39, in parallel: (s4, s9, in parallel: (s13, s15, **s21**, s24, s27) and (s14, s16, **s22**, s25, s28), s30, **g10**, s32, s38) and (s5, s7, **s36**, s37, s39), s31, c46 |
| **10** | input(10, lie, nor, professional, noChoice, n/a, [], choice, nonExclusive, [aut, cze, hun], [aut, cze, hun, svk, svn], [aut, cze, hun, svk, svn], aut). | c1, c3, p3, p43, p7, p11, p40, **p41**, p42, p38, c46 |
| **11** | input(11, lie, nor, professional, choice, nonExclusive, [aut, deu, che], choice, nonExclusive, [aut, cze, hun], [aut, cze, hun, svk, svn], [aut, cze, hun, svk, svn], aut). | c1, c3, p3, p43, p7, p13, p19, p24, **p28**, p32, p35, **p37**, p36, p38, c46 |
| **12** | input(12, isl, nor, consumer, choice, nonExclusive, [nor, deu, swe], choice, nonExclusive, [nor, dnk, swe], [nor, dnk], [aut, bel, bgr, cyp, cze, dnk, est, fin, fra, deu, grc, hun, irl, ita, lva, ltu, lux, mlt, nld, pol, prt, rou, svk, svn, esp, swe, gbr, nor, isl, che, lie], isl). | c1, c4, c6, p43, p7, p13, p17, p40, **p41**, p42, p38, c46 |
| **13** | input(13, isl, nor, consumer, choice, nonExclusive, [nor, deu, swe], choice, nonExclusive, [che, dnk, bgr], [nor, dnk], [aut, bel, bgr, cyp, cze, dnk, est, fin, fra, deu, grc, hun, irl, ita, lva, ltu, lux, mlt, nld, pol, prt, rou, svk, svn, esp, swe, gbr, nor, isl, che, lie], isl). | c1, c4, c6, p43, p7, p13, p17, p40, **p41**, p42, p38, c46 |
| **14** | nput(14, lie, nor, professional, choice, exclusive, [aut, hun, che], choice, exclusive, [aut, cze, hun], [aut, cze, hun, svk, svn], [aut, cze, hun, svk, svn], aut). | c1, c3, p3, p43, p7, p13, p19, p25, **p29**, p33, p35, **p37**, p36, p38, c46 |
| **15** | input(15, aut, aut, professional, choice, exclusive, [aut, deu, che], choice, exclusive, [aut, cze, hun], [aut, cze, hun, svk, svn], [aut, cze, hun, svk, svn], aut). | c1, c3, p5, p44, p12, p18, p23, **p27**, p31, p38, c46 |
| **16** | input(16, aut, nor, consumer, noChoice, n/a, [], noChoice, n/a, [], [nor, dnk], [aut, bel, bgr, cyp, cze, dnk, est, fin, fra, deu, grc, hun, irl, ita, lva, ltu, lux, mlt, nld, pol, prt, rou, svk, svn, esp, swe, gbr, nor, isl, che, lie], aut). | c1, c4, c7, c10, **c11**, c13, c16, c19, **c22**, c25, **c28**, c29, c30, c34, c46 |
| **17** | input(17, aut, nor, consumer, choice, nonExclusive, [aut, deu, che], choice, nonExclusive, [che, dnk, swe], [nor, dnk], [aut, bel, bgr, cyp, cze, dnk, est, fin, fra, deu, grc, hun, irl, ita, lva, ltu, lux, mlt, nld, pol, prt, rou, svk, svn, esp, swe, gbr, nor, isl, che, lie], aut). | c1, c4, c7, c10, **c11**, c16, c19, **c22**, c25, **c28**, c29, c30, c35, c48, **c50**, c47, c46 |
| **18** | input(18, cyp, nor, consumer, noChoice, n/a, [], choice, nonExclusive, [nor, dnk, try], [nor, try], [cyp, dnk, gbr, grc, nor, pol, try], cyp). | c1, c4, c7, c10, c11, c13, c16, c20, **c23**, c26, c30, c34, c46 |
| **19** | input(19, cyp, nor, consumer, noChoice, n/a, [], choice, nonExclusive, [nor, aut, cze, hun], [nor, aut], [nor, aut, cze, hun, svn], grc). | c1, c4, c7, c9, p44, p8, p39, in parallel: (s4, s6, **s34**, s35, s38) and (s5, s11, s17, **s23**, s26, s29, **g11**, s33, s39), s31, c46 |

output variables. Input variables consist primarily of connecting factors and IDs for specific input variations as defined in `input/13` fact predicates (see Section 7.3). Output variables consist primarily of IDs and jurisdiction-related output obtained in action nodes. The following list describes the 16 output variables for the implementation's core predicate `jurisdictions/16`. As this predicate carries along all possible jurisdiction-related output variables, this list is self-contained with respect to jurisdiction output. It must be noted that all jurisdiction-related output variables are either a ISO three-character, non-capitalized country code or a list thereof.

**ID** — The identifier of a test case. *Cf.* `input/13` predicate description in Section 7.3.

**SNCCjurisdiction** — SNCC is a code (left-to-right): S=Special, N=Non-exclusive, C=Contract, C=Customer. This means that this output variable determines "Special, non-exclusive jurisdiction in relation to contract, for service customer claims". There is not only a single jurisdiction, but multiple jurisdictions that an activity diagram may identified. These jurisdictions must be differentiated from each other so that they can be brought into a hierarchy of jurisdictions (see Section 6.4). `SNCCjurisdiction` is a single type of jurisdiction considered here as a possible jurisdiction output. The code SNCC is used as an abbreviation for the respective full syntax specified in Figure 6.1. This type of jurisdiction is determined in action nodes c14, c23, c28, and s21.

**SNCCjurisdiction2** — *Cf.* `SNCCjurisdiction`. Regarding numbering: Non-exclusive jurisdiction is additive, meaning if there are two non-exclusive jurisdictions one does not supersede the other. In some paths, there are multiple non-exclusive jurisdictions possible (*e.g.*, [...], c14, c18, c21, c24, c32, c44, c49, c45, c46) — these are numbered and preserved along a path. This type of jurisdiction is determined in action nodes c21 and c50.

**SNCCjurisdiction3** — *Cf.* `SNCCjurisdiction` and `SNCCjurisdiction2`. This type of jurisdiction is determined in action node c49.

**SNECjurisdiction** — *Cf.* `SNCCjurisdiction`. SNEC means: S=Special, N=Non-exclusive, E=Establishment, C=Customer. This type of jurisdiction is determined in action nodes c22, c51, and s22.

**SECPjurisdiction** — *Cf.* `SNCCjurisdiction`. SECP means: S=Special, E=Exclusive, C=Contract, P=Provider. This type of jurisdiction is determined in action node c11.

**IgnoredJurisdiction:** In case contract parties want to make a choice of jurisdiction, and they actually come to a jurisdiction agreement, but this agreement cannot be accepted by law for this specific configuration, the chosen but ignored jurisdiction is listed. This type of jurisdiction is determined in action nodes c38 and c41.

**SNCBjurisdiction** — *Cf.* `SNCCjurisdiction`. SNCB means: S=Special, N=Non-exclusive, C=Contract, B=Both. This type of jurisdiction is determined in action nodes p26 and p28.

**SNCPjurisdiction** — *Cf.* `SNCCjurisdiction`. SNCP means: S=Special, N=Non-exclusive, C=Contract, P=Provider. This type of jurisdiction is determined in action node s23.

**GNCCjurisdiction** — *Cf.* `SNCCjurisdiction`. GNCC means: G=General, N=Non-exclusive, C=Contract, C=Customer. This type of jurisdiction is determined in action node g10.

**GNCPjurisdiction** — *Cf.* `SNCCjurisdiction`. GNCP means: G=General, N=Non-exclusive, C=Contract, P=Provider. This type of jurisdiction is determined in action node g11.

**NoCjurisdiction** — In some cases, no jurisdiction by virtue of the law — Brussels I — can be determined. Nevertheless, the formal requirements listed in Section 6.4 ask always for at least one jurisdiction-related statement to be run through. Hence, if such a case is hit, then this is mentioned in the output. NoC is a code and means: No=No jurisdiction, C=Customer. Accordingly, `NoCjurisdiction` stands for "No jurisdiction for service customer claims by virtue of Brussels I". This type of jurisdiction is determined in action node s34.

**NoPjurisdiction** — *Cf.* `NoCjurisdiction`. NoP is a code and means: No=No jurisdiction, P=Provider. This type of jurisdiction is determined in action node s36

**SECBjurisdiction** — *Cf.* `SNCCjurisdiction`. SECB means: S=Special, E=Exclusive, C=Customer, B=Both. This type of jurisdiction is determined in action nodes p27 and p29.

**DeniedJurisdiction** — Brussels I mentions explicitly for specific cases that some of its member states cannot have jurisdiction. `DeniedJurisdiction` lists these states if such case applies. This type of jurisdiction is determined in action node p37.

**NoJurisdiction** — *Cf.* `NoCjurisdiction`, except that, in this case, no jurisdiction can be determined by virtue of Brussels I for claims of both contract parties. This type of jurisdiction is determined in action node p41.

In addition to those predicates implementing partial paths a number of helper predicates, mainly for Prolog list operations, have been implemented. Of special note here is `memberStates/1`. This supporting predicate defines member states of Brussels I in terms of a Prolog list containing ISO three-character, non-capitalized country codes. Moreover, supporting predicates exist for the management of choice of jurisdiction (`disagreement/2`, `chosenJurisdiction/3`, `nonChosenMemberStates/2`) and to handle Brussels I member state status (`memberState/1`, `establishmentsInMemberStates/2`, `chosenStateIsMemberState/1`).

In order to show how predicates for partial paths are implemented an example case is presented. This case reflects test case 15 as outlined in Section 7.3. For case 15, which is a very simple case, a path of c1, c3, p5, p44, p12, p18, p23, p27, p31, p38, c46 is expected as Table 7.2 specifies. The implementation does not define a predicate for c1 since this control flow is taken with every path and it does not carry along any information nor does it require

any input to make a decision. The first predicate defined in this example path implements c3. Figure 7.2 documents the set of predicates implemented in relation to this case, including the respective predicate for c3, (`c3/1`).

```
c3(ID) :- input(ID, _, _, CustomerConsumer, _, _, _, _, _, _, _, _, _),
        CustomerConsumer\=consumer.

p5(ID) :- c3(ID),
        input(ID, CustomerDomicile, _, _, _, _, _, _, _, _, _, _, _),
        memberState(CustomerDomicile).

p44(ID) :- c9(ID);
        p5(ID);
        p6(ID).


p12(ID) :- p44(ID),
        input(ID, _, _, _, CustomerChoice, _, _, ProviderChoice, _, _, _, _, _),
        CustomerChoice==choice,
        ProviderChoice==choice.

p18(ID, Choice) :- p12(ID),
        input(ID, _, _, _, _, _, CustomerPreferred, _, _, ProviderPreferred, _, _, _),
        not(disagreement(CustomerPreferred, ProviderPreferred)),
        chosenJurisdiction(CustomerPreferred, ProviderPreferred, Choice),
        chosenStateIsMemberState(Choice).

p31(ID, SECBjurisdiction) :- p18(ID, Choice),
        input(ID, _, _, _, _, CustomerExclusiveChoice, _, _, ProviderExclusiveChoice, _, _, _, _),
        not(
                (
                        CustomerExclusiveChoice==nonExclusive,
                        ProviderExclusiveChoice==nonExclusive
                )
        ),
        SECBjurisdiction=Choice.

p38(ID, SECBjurisdiction, SNCBjurisdiction, DeniedJurisdiction, NoJurisdiction) :-
        p31(ID, SECBjurisdiction);
        p36(ID, SNCBjurisdiction, SECBjurisdiction, DeniedJurisdiction);
        p42(ID, NoJurisdiction).

jurisdictions(ID, SNCCjurisdiction, SNCCjurisdiction2, SNCCjurisdiction3, SNECjurisdiction,
        SECPjurisdiction, IgnoredJurisdiction, SNCBjurisdiction, SNCPjurisdiction, GNCCjurisdiction,
        GNCPjurisdiction, NoCjurisdiction, NoPjurisdiction, SECBjurisdiction, DeniedJurisdiction,
        NoJurisdiction) :-
        (
                c45(ID, SNCCjurisdiction, SNCCjurisdiction2, SNCCjurisdiction3, SNECjurisdiction,
                        SECPjurisdiction);
                c39(ID, SNCCjurisdiction, SNCCjurisdiction2, SNECjurisdiction, SECPjurisdiction,
                        IgnoredJurisdiction);
                c33(ID, SNCCjurisdiction, SNCCjurisdiction2, SNECjurisdiction, SECPjurisdiction);
                s31(ID, SNCBjurisdiction, SNCCjurisdiction, SNCPjurisdiction, GNCCjurisdiction,
                        GNCPjurisdiction, SNECjurisdiction, NoCjurisdiction, NoPjurisdiction);
                p38(ID, SECBjurisdiction, SNCBjurisdiction, DeniedJurisdiction, NoJurisdiction);
                c34(ID, SNECjurisdiction, SNCCjurisdiction, SECPjurisdiction);
                c40(ID, SNECjurisdiction, SNCCjurisdiction, SECPjurisdiction, IgnoredJurisdiction);
                c47(ID, SNECjurisdiction, SNCCjurisdiction, SNCCjurisdiction2, SECPjurisdiction)
        ).
```

Figure 7.2: Implementation Excerpt Showing Predicate Definitions for Paths in Relation to Test Case 15

Predicate `c3/1` has one output variable (`ID`). It constitutes an implication which decides based on two variables (`ID` and `CustomerConsumer`) if a service customer is a consumer. Predicate `c3/1` implements an output edge of a decision node, that of c2. Similarly, predicate `p5/1` is "true" if the answer to decision node p2 is "yes". A value of "true" for `p5/1` implies that `c3/1` is "true" and that `CustomerDomicile` denotes a member state. Predicate `p44/1` implements a merge node implying that predicates `c9/1`, `p5/1`, or `p6/1` are

true. Predicate `p12/1` implies `p44/1` to be "true" and that both contract parties want to make a choice of jurisdiction.

While all predicates introduced so far had a single output variable only, from predicate `p18/2` onwards, further information beyond the identifier of a test case is carried along a path. In case of `p18/2` this concerns the state which both contract parties are willing to assign jurisdiction to. This information is needed in other predicates so that it serves as decision making input there. In the example path shown, the case in predicate `p32/2` assigns the respective chosen state to its output variable of `SECBjurisdiction`, if neither contract party wants to make the choice of jurisdiction a non-exclusive one.

Since predicate `p38/5` implements a merge node with `p32/2` being only one out of three possible input edges, output variables of `p38/5` must consider all information carried along all inputs. Besides the two variables of relevance to `p32/2`, this includes three additional notions of jurisdiction output. Finally, after p38 was passed in the example path assessed, c46 is taken — which is reflected by `jurisdictions/16`.

## 7.5 Jurisdiction Queries and Functional Evaluation

Based on previous discussions about partial paths, connecting factor variations, and implication predicates, this section presents results obtainable when interacting with the Prolog decision engine. Queries for partial or full paths combined with the set of test cases specified make a functional evaluation possible. In this context, the section at hand explains in what terms function is assessed for the implementation of Brussels I, whereas further evaluation dimensions such as security, scalability, and performance are not covered here. Similarly, aspects of deployment — *e.g.*, which component to run where/in which administrative domain — are not addressed at all. In non-technical terms, hence, to "make the implementation work" and to show feasibility of an automated determination of jurisdiction according to Brussels I constitute the key aspects of interest.

A key aspect of the partial path implementation approach is that function assessment is made available at all stages of development. This allows for immediate testing by debugging partial paths instead of complete paths. Since partial paths are considerably less complex to assess than complete ones, the development process is actively accelerated. This is illustrated by means of the same example used in Section 7.4 in relation to test case 15. After compiling the Prolog code, the Prolog interpreter may be queried about each predicate implemented. For instance, for `c3/1` the query "?- c3(ID)." lists all test case IDs which involve a consumer as a service customer. The output reads like:

```
1 ;
9 ;
10 ;
11 ;
14 ;
15 ;
false.
```

This means that the Prolog interpreter found connecting factor variations — test cases — with IDs 1, 9, 10, 11, 14, and 15 which satisfy the implication of `c3/1`. This outcome is in-

line with the expected results documented in Table 7.2. The test cases mentioned represent those variations for which `CustomerConsumer` has a value of "consumer" and for which the corresponding path goes through c3.

```
?- p38(ID, SECBjurisdiction, SNCBjurisdiction, DeniedJurisdiction,
|  NoJurisdiction).
ID = 15,
SECBjurisdiction = [aut] ;
ID = 11,
SNCBjurisdiction = [aut],
DeniedJurisdiction = [bel, bgr, cyp, cze, dnk, est, fin, fra, deu|...] ;
ID = 14,
SECBjurisdiction = [aut],
DeniedJurisdiction = [bel, bgr, cyp, cze, dnk, est, fin, fra, deu|...] ;
ID = 7,
SECBjurisdiction = [deu],
DeniedJurisdiction = [aut, bel, bgr, cyp, cze, dnk, est, fin, fra|...] ;
ID = 10,
NoJurisdiction = noJurisdictionByBrusselsI ;
ID = 12,
NoJurisdiction = noJurisdictionByBrusselsI ;
ID = 13,
NoJurisdiction = noJurisdictionByBrusselsI ;
false.
```

Figure 7.3: Example Query and Obtained Output for Predicate p38/5

Analogously, the same testing procedure applies to more complicated predicates, *e.g.*, to `p38/5` as the query and output show in Figure 7.3. This query asks about test cases for which all requirements to pass control flow p38 in the Brussels I activity diagram are given. Consequently, the Prolog interpreter searches for `input/13` facts which reflect possible partial paths arriving at p38. For the set of test cases determined in Table 7.2, pre-conditions to reach p38 are satisfied for connecting factor variations with IDs 7, 10, 11, 12, 13, 14, and 15. For each test case found, case-specific jurisdiction output is listed. Case-specific means that the set of output variables returned by the Prolog interpreter for a given case identified contains only those variables (and the according values) for which a value was determined throughout a full path.

For test case 12, for instance, a single output variable was attributed a value until control flow reached p38, namely that of `NoJurisdiction`. On the other hand, test case 11 reflects a path in which twice a statement about jurisdiction was made until p38 was reached. Special, non-exclusive jurisdiction in relation to contract, for service customer claims, was set to Austria, and `DeniedJurisdiction` was noted to embrace all Brussels I member states except for Austria. Again, these results obtained are fully in-line with the expected result documented in Table 7.2. Case 12 is expected to see only one jurisdiction statement to be made, namely in action node p41 where `NoJurisdiction` is attributed. Case 11 is expected to see two jurisdiction statements. The first is supposed to happen in activity node p28 where chosen jurisdiction is adopted as `SNCBjurisdiction`. Chosen jurisdiction is in this case — according to customer and provider preferences expressed — Austria (determined by predicate `p19/2`).

Finally, Figure 7.4 presents the implementation's main output when querying the Prolog interpreter for `jurisdictions/16`. This predicate represents the main predicate for jurisdiction recommendations as it reflects the last predicate before the terminal node in Brussels I is reached. The output obtained shows that for all 19 test cases used the respective case-specific set of jurisdiction variables is attributed the relevant values. By means of this output, the implementation proves to deliver results which are exactly those expected from

```
?- jurisdictions(ID, SNCCjurisdiction, SNCCjurisdiction2, SNCCjurisdiction3,
|    SNECjurisdiction, SECPjurisdiction, IgnoredJurisdiction,
|    SNCBjurisdiction, SNCPjurisdiction, GNCCjurisdiction,
|    GNCPjurisdiction, NoCjurisdiction, NoPjurisdiction, SECBjurisdiction,
|    DeniedJurisdiction, NoJurisdiction).
ID = 4,
SNCCjurisdiction = svk,
SNCCjurisdiction2 = aut,
SNCCjurisdiction3 = [hun],
SNECjurisdiction = [svk, svn],
SECPjurisdiction = svk ;
ID = 5,
SNCCjurisdiction = svk,
SNCCjurisdiction2 = aut,
SNCCjurisdiction3 = [ita],
SECPjurisdiction = svk ;
ID = 2,
SNCCjurisdiction = svk,
SNCCjurisdiction2 = aut,
SNECjurisdiction = [cze, hun, svk, svn],
SECPjurisdiction = svk ;
ID = 8,
SNCCjurisdiction = aut,
SNCCjurisdiction2 = aut,
SNECjurisdiction = [cze, hun, svk, svn],
SECPjurisdiction = aut ;
ID = 9,
SNECjurisdiction = [cze, hun, svk, svn],
GNCCjurisdiction = aut,
NoPjurisdiction = noJurisdictionByBrusselsI ;
ID = 1,
SNECjurisdiction = [cze, hun, svk, svn],
SNCBjurisdiction = [aut],
GNCCjurisdiction = aut,
GNCPjurisdiction = aut ;
ID = 3,
SNCCjurisdiction = svk,
GNCCjurisdiction = aut,
GNCPjurisdiction = svk ;
ID = 19,
SNCPjurisdiction = grc,
GNCPjurisdiction = cyp,
NoCjurisdiction = noJurisdictionByBrusselsI ;
ID = 15,
SECBjurisdiction = [aut] ;
ID = 11,
SNCBjurisdiction = [aut],
DeniedJurisdiction = [bel, bgr, cyp, cze, dnk, est, fin, fra, deu|...] ;
ID = 14,
SECBjurisdiction = [aut],
DeniedJurisdiction = [bel, bgr, cyp, cze, dnk, est, fin, fra, deu|...] ;
ID = 7,
SECBjurisdiction = [deu],
DeniedJurisdiction = [aut, bel, bgr, cyp, cze, dnk, est, fin, fra|...] ;
ID = 10,
NoJurisdiction = noJurisdictionByBrusselsI ;
ID = 12,
NoJurisdiction = noJurisdictionByBrusselsI ;
ID = 13,
NoJurisdiction = noJurisdictionByBrusselsI ;
ID = 16,
SNCCjurisdiction = aut,
SNECjurisdiction = [dnk],
SECPjurisdiction = aut ;
ID = 18,
SNCCjurisdiction = cyp,
SECPjurisdiction = cyp ;
ID = 6,
SNCCjurisdiction = aut,
SNECjurisdiction = [dnk],
SECPjurisdiction = aut ;
ID = 17,
SNCCjurisdiction = aut,
SNCCjurisdiction2 = [che],
SNECjurisdiction = [dnk],
SECPjurisdiction = aut ;
false.
```

Figure 7.4: Query and Obtained Jurisdiction Output for Predicate jurisdictions/16

test case definitions and when going through the Brussels I activity diagram accordingly. Therefore, the implementation is found to facilitate for the set of connecting factor variations tested a correct, automated determination of jurisdiction according to the PIL modeled, the Brussels I regulation.

## 7.6 Valuation of Results

With the case study conducted, and with the information model, the PIL modeling method, and a prototype implementation of the DeRISC decision support system made available, a valuation of those results obtained becomes possible. Accordingly, a number of conclusions with respect to multiple dimensions as follows is drawn:

- Contributions made (gaps 1 and 2 of Section 2.9)
- Decision support requirements met (gaps 3, 5, and 5 of Section 2.9)
- Feasibility shown and functionality assessed
- Considerable step towards increased legal certainty made

**Contributions made** — The successful design, implementation, and functional evaluation of the DeRISC decision support system constitutes the fourth major contribution foreseen in this thesis. DeRISC, thus, completes the set of contributions determined by gaps 1 and 2 identified in Section 2.9. The implementation, which is part of gap 1, reflects the information model developed. And it implements the outcome of the PIL modeling method, i.e., it implements the UML activity diagram of a PIL modeled. Both information model and PIL modeling method constitute the two other major contributions foreseen within the scope of gap 1. Moreover, mainly the information model is driven by the case study conducted and the according notion of service and service contract obtained. These notions of service and contract form the major contribution foreseen in this thesis within the scope of gap 2. Therefore, the set of four major contributions foreseen is deemed fully achieved with the effective DeRISC implementation. Accordingly, gaps 1 and 2 are deemed fully addressed.

**Decision support requirements met** — The DeRISC decision support system is implemented as a rule-based system. It produces recommendations on suited jurisdictions according to a knowledge base and an inference machine. The knowledge base embraces rules and facts, and the inference machine determines when (based on which facts) a particular rule is applied. Accordingly, DeRISC addresses gap 5, which asks for an implementation as a rule-based system. Equally, gaps 3 and 4 are fully addressed. Gap 4 requires the information model to be an extension of the established SLM-driven information model presented. DeRISC reflects both information concepts and information artifacts as determined in the (extended) information model developed. Gap 3, finally, is concerned with legal consistency and compliance with respect to the PIL modeling method determined. Since DeRISC represents a direct implementation of a UML activity diagram obtained in modeling a PIL, and since the modeling

method is fully documented with respect to aspects of legal consistency and compliance, the implementation is found consistent and compliant in the same way as the modeling method was found consistent and compliant.

**Feasibility shown and functionality assessed** — DeRISC shows by means of a complete and concrete case — that of the Brussels I regulation, which is the primary PIL source in Europe — that an automated determination of jurisdiction recommendations at the time of contract conclusion is feasible. Feasibility has been proven on all levels of gaps addressed. The concrete example of Brussels I and in particular its implementation has shown fully functional. By help of the set of determined test cases, a functional evaluation of partial as well as complete paths through the Brussels I activity diagram was shown. By that, it can be concluded that the implementation is able to deliver meaningful jurisdiction recommendations, whereas meaningful means here that recommended jurisdictions may be of actual help for a service provider and service customer to conclude an international service contract which sees increased legal certainty.

**Considerable step towards increased legal certainty made** — DeRISC enables the first-ever and the only known machine-executed reasoning on dispute resolution means in a PIL-compliant manner. Clearly, the current implementation sees limitations, such as in terms of geographical coverage (with the European perspective being covered at this point only) and usability as well as accessibility (system functionality is currently made available by a direct interaction with the Prolog interpreter only). Nevertheless, these implementation-related limitations cannot overshadow the considerable knowledge advancement made by the PIL modeling method and the DeRISC decision support system implemented. DeRISC can be extended with further PILs being modeled and implemented. And the system's functionality can be made available in a more usable and approachable way, for instance, by building an end user-friendly wrapper that encapsulates the Prolog reasoning component. The key point here is the presence of a well suited modeling and implementation method as well as of an implementation that produces legally compliant recommendations. Service providers and service customers obtain for the first time ever the opportunity to assess at the time of contract formation means of dispute resolution that are suited specifically to the very contract they are about to conclude. Even though DeRISC adopts an approach of covering primarily standard cases (in order to reduce complexity), the recommendations that both contract parties receive at an early point in the contract lifecycle are clearly superior to the way dispute resolution is handled today in international service contracting. Since DeRISC produces recommendations that have been reasoned upon based on the relevant contract party- and contract-specific connecting factors, the expectation on a recommendation's validity is considerably higher — plus, any recommendation is traceable back to the respective article(s) in a considered PIL that led to a recommendation being made.

## 7.7 DeRISC Decision Support System Summary

Based on the modeling output obtained and in consideration of the information model determined, this chapter has sketched a system design with two pre-determined inputs — Prolog

decision rules and facts to include test cases — and with interactive input in terms of jurisdiction queries. Moreover, the system design covers interactive jurisdiction output delivered by the Prolog decision engine (*cf.* Figure 7.1). In compliance with this design, the first step in implementing consisted in splitting the activity diagram for Brussels I into partial paths. Partial paths show advantages in functionality re-use, partial testing, and they serve as direct templates for an implementation of rules expressed as predicates in Prolog notation.

Before these rules were implemented, the full set of 12 connecting factors for Brussels I was listed and explained. Connecting factors include information about contract party domiciles, whether a service customer is a consumer, party will and preferences to make a choice of jurisdiction, locations of provider establishments, a provider's target markets, and location of performance of a service in question. The implementation was concluded by considerations of jurisdiction queries and a functional evaluation conducted. The first was explained exemplarily by means of the implementation covering a complete path through the diagram of Brussels I. The latter was discussed by comparing results obtained from different predicate queries with the respective expected result according to a matching test case.

By valuating the results obtained in this chapter, DeRISC was deemed to complement this thesis' first three major contributions — case study, information model, and modeling method — in terms of a successful fourth major contribution. In this light, the implementation represents the last cornerstone to address gaps 1 and 2 (contributions foreseen in this thesis) as raised in Chapter 2. Equally, gaps 3 to 5 were found to be fully addressed, as with an effective implementation at hand all decision support requirements have been met. In terms of functionality and feasibility, the implementation has proven to be fully functional. It represents the first and only fully machine-executable implementation of the Brussels I regulation to date.

# Chapter 8

# Summary and Conclusions

Driven by the observed status quo in international service contracting, the respective hypothesis and purpose of this thesis have been termed. As for status quo, international service contracts are found to cover provisions on jurisdiction and applicable law. However, these provisions are typically not determined in compliance with PIL, but they are unilaterally imposed, static, and irrespective of contract-, service-, and contract party-specific connecting factors.

This observation gains in importance when assuming that demand for electronic business in the Internet — and with that demand for service contracts to be concluded — is significant today, and demand is expected to grow furthermore. Even more so, as the number of cross-border transactions in electronic business in the Internet is assumed considerable, jurisdiction and applicable law provisions are deemed highly relevant.

Hence, this thesis is committed to follow its purpose which has been framed as to facilitate a PIL-compliant conclusion of international service contracts in the Internet. This purpose is in support of the accordingly developed hypothesis: PIL compliance is argued to result in lowered overall business transaction costs by means of altered risk assessment. The way to address the purpose outlined has been identified in terms of the specific problem to be solved. This thesis' problem to be solved, thus, has been defined to determine in an automated and PIL-conforming manner recommendations on suited jurisdiction(s) and applicable law(s) for an international service contract to be concluded.

With the relevant purpose, hypothesis, and problem formulated, the set of four claims has been compiled. These claims, in turn, have been translated into the key set of five specific objectives with respect to the design, implementation, and testing of the DeRISC (Dispute rEsolution Recommender for International Service Contracts) decision support system to produce jurisdiction and/or applicable law recommendations. In addition to claims and objectives, the set of five gaps has been identified based on an in-depth analysis of background information and related work. Claims, objectives, and primarily the identified gaps have shaped the range of four major contributions as follows:

**Contribution 1: International service contract case study** — Based on a real-world, complex service contract construct assessed, a profound service and international service contract understanding has been obtained. This contractual notion is fundamental to the remaining contributions in this thesis. In particular, it helped shape the information model.

**Contribution 2: Information model covering service and contract management** — The understanding gained in the case study conducted has provided the solid basis for extending an established information model in ITSM with the relevant perspective on contract management. In particular, information concepts and information artifacts have been determined to reflect characteristics of international service contracts.

**Contribution 3: PIL modeling method** — In order to ensure legal compliance and consistency with the relevant PIL basis an extensive method to identify, analyze, and formally model a PIL of interest has been developed. This method considers information concepts and artifacts of the information model determined. It results in a UML2 activity diagram representing a given PIL source.

**Contribution 4: Decision support system producing recommendations** — Driven by the outlined problem to be solved in this thesis, a service provider and a service customer need decision support when forming a service contract with international connection. To this aim, a previously modeled activity diagram is implemented by DeRISC as a rule-based system establishing a decision support system which produces recommendations on jurisdiction(s) and/or applicable law(s).

In terms of gaps addressed, a detailed results valuation discussion has revealed that all four contributions foreseen have been fully and successfully achieved. Equally, all five gaps identified were found completely addressed. Consequently, this chapter looks at claims and objectives raised and it determines for each of them in a qualitative analysis whether and to what extent a claim and objective is met, respectively. Driven by this analysis, conclusions with respect to areas of future work are drawn. This is complemented by an overview of possible ways determined to address complexity in future work.

## 8.1 Claims and Objectives Addressed

In consideration of those four major contributions achieved and the set of five gaps successfully addressed, those four claims raised initially are assessed qualitatively as follows:

**Claim 1: Trust-building in international electronic business** — Lack of trust in international electronic business is perceived as a major hurdle to wider adoption of commercial electronic service provisioning and to implement harmonized markets. Accordingly, this thesis aims to foster trust of service customers and service providers in international electronic business. The existence of additional information at the time of contract formation made available by DeRISC is clearly rated as a trust-building measure. Additional information shows characteristics of recommendations. Without DeRISC, contract parties do not dispose of any information at all. In particular, they lack a notion of suited, *i.e.*, recommendable jurisdiction(s) and applicable law(s) — recommendations that were determined according to the relevant legal basis, following a fully documented law modeling and implementation method.

**Claim 2: Increased legal certainty in international service contracting** — The observed status quo in international service contracting bears considerable risks for both contract parties. With respect to dispute resolution means, this is mainly due to legal uncertainty

in valuing risks of foreign jurisdiction and foreign law applied. None of the four major contributions achieved in this thesis is able to produce guaranteed legal certainty and to overcome the inherent design gap between the borderless infrastructure of the Internet and the territorial perspective of PIL. Nevertheless, this thesis reveals a path toward increased legal certainty, especially by the design and implementation of the DeRISC decision support system which produces recommendations that both contract parties can rely on as they have been determined in accordance with PIL and based on a transparent method.

**Claim 3: Legal compliance in determining jurisdiction and applicable law** — The production of a list of recommended jurisdiction(s) and applicable law(s) follows the procedures imposed by the respective PIL modeled and implemented directly. As long as the relevant set of PILs is modeled and implemented, the relevant set of recommendations may be obtained. Thus, legal compliance is provided, in principle. Alone, erroneously modeled provisions cannot be excluded completely. This is perceived less an issue of the PIL modeling method developed than an issue of how to correctly interpret running text in a law — laws do not constitute formal specifications. Hence, a certain degree of interpretation remains unavoidable.

**Claim 4: Risk assessment due to informed choices and PIL awareness** — For producing a list of recommended jurisdiction(s) and applicable law(s), the respectively relevant connecting factors must be know. In case of Brussels I, the set of 12 connecting factors was required. In a productive decision support system, both contract parties would be required to submit a set of connecting factors initially. The fact alone that both contract parties would have to answer imperatively about a number of these factors implies a minimum degree of awareness that the contract to be concluded would have international connection (*e.g.*, customer from a foreign state, provider from a foreign state). Given such minimum degree of awareness assumed, both contract parties are likely to realize that a potential dispute might bear certain risks — even if the actual detailed legal consequences may not be appreciable.

The set of four claims raised, hence, is deemed addressed successfully with those reservations made. This thesis is found accordingly to foster, in principle, trust in international electronic business, to increase legal certainty, to determine recommendations in compliance with PIL, and to allow for risk assessment due to informed choices and PIL awareness. Subsequent to the qualitative claim assessment conducted, the comparable qualitative assessment of those five objectives determined is performed.

**Objective 1: Automation support** — DeRISC allows for automated reasoning. It implements an activity diagram modeled for a given PIL as a rule-based system. Both, modeling method and decision support system implementation, envision an automated determination of jurisdiction and/or applicable law recommendations. Hence, automation support is provided, in principle. The way the DeRISC prototype for Brussels I is implemented, however, relies on pre-determined input in terms of facts. Facts reflect connecting factors. In a productive decision support system, not only the reasoning, but also the acquisition of connecting factors from both contract parties would have to be implemented dynamically.

As for the three sub-objectives identified within this objective, DeRISC is found to produce results in terms of recommendations. It produces recommendations in accordance with the underlying modeled and implemented PIL procedures considered, and it implements activity diagrams which result from a modeling method that translates any *ex post* provision (focus on contract enforcement phase) to the respective *ex ante* provision (focus on contract formation phase).

**Objective 2: Integration of different national and supra-national PILs** — All contributions achieved throughout this thesis are designed in a way to allow for flexibility in terms of general application and extension. This means that, even though an example service contract and an example PIL was used to concretize contributions at all levels, the service and contract notion obtained in the case study conducted is generic enough that the developed information model features information concepts of wide applicability. With respect to information artifacts, the information model currently foresees specific artifacts for Brussels I and Rome I. Should further artifacts be needed when considering other PIL sources, additional artifacts may be added without the need to change existing artifacts, the existing Brussels I activity diagram, or the existing DeRISC decision support system for Brussels I. Extension, thus, at all levels is possible and even foreseen. Furthermore, Annex B.1 proves for the case of the Swiss national PIL that the PIL modeling method may be successfully applied to other PIL sources. The same holds true for an implementation of the respective decision support system as the implementation method is not specific to a single PIL, but it considers generally applicable guidelines to implement an activity diagram as a rule-based system.

**Objective 3: B2C and B2B support** — The case study conducted considers a B2B contractual relation. All further contributions of this thesis consider B2C and B2B relations. For instance, the information model includes a Brussels-I-specific information artifact holding information about whether a service customer is a consumer (B2C). Similarly, the activity diagram modeled for Brussels I and the according DeRISC decision support system implemented differentiate B2C and B2B relations. In other PILs, this differentiation might not be relevant. Nonetheless, the information model, the PIL modeling method, and DeRISC provide full support for both.

**Objective 4: Scope of international service contracts** — The information model, the PIL modeling method, and the implementation method consider provisions of PIL relevant to international, commercial, and electronic provisioning of services exclusively. This is due to the scope definition outlined in this thesis. However, a wider focus including so far not envisaged service contracts of similar types may be accommodated at a later stage. In the same line of argumentation used for objective 2, the information model, the modeling method, and the implementation method support extensions beyond the scope adopted here.

**Objective 5: Scalability by means of complexity reduction** — All contributions have revealed a considerable amount of complexity faced. In particular, the PIL modeling method is affected by complexity and scalability issues. Scalability with respect to a wider geographic, electronic business scheme, and service contract type coverage

has been achieved mainly by means of complex reduction through abstraction. Consequently, the PIL modeling method focuses on standard cases. It emphasizes legal compliance and, thus, reliable recommendations produced for frequent and likely contractual relations. On the other hand, it abstracts way exceptions and reservations. This decision reflects a trade-off between scalability and specifics. As the detailed inclusion and exclusion criteria for modeling a PIL source, however, are fully documented, any limitation in specifics is made transparent and comprehensible.

In conclusion, the qualitative analysis of those five objectives raised initially reveals that all objectives have been met successfully. This means that in addition to the set of effectively addressed claims and gaps, the contributions achieved in this thesis provide sufficient support for automation and they are extensible with respect to a wider geographic, business scheme, and service contract type scope, in principle. Extensibility and complexity reduction through abstraction contribute equally to achieve scalability in future work.

Consequently, this thesis provides significant impact from and legal and from a computer science point of view. It facilitates considerable knowledge advancements in both domains. From a legal perspective, the major impact provided is in showing the boundaries of PIL as a highly diverse and complex field of law with respect to what diversity and complexity mean to electronic business in the Internet. Creating awareness among legal experts about high risk levels and uncertainty in a global service economy, hence, is the primary legal impact being made here. From a computer science perspective, the major impact is found in automated reasoning that produces meaningful and technically correct results, even though it bases on rules and facts that essentially are not foreseen for machine-execution and that presume a different time in the contract lifecycle. DeRISC, hence, shows how computer science can, in principle, address complex problem solving. The modeling of suited information concepts and artifacts by application and extension of methods in ITSM and SLM as well as the development of a scalable, generally applicable, and proven PIL modeling method resulting in standards-compliant UML activity diagrams are equally required elements of computer science to make this impact happen.

## 8.2 Future Work and Complexity Mitigation Strategies

The overall three-step procedure as shown in Figure 3.3 has been developed according to procedures applicable to international contract claims. In this context, the contributions of this thesis determine major achievements in terms of a common basis for a PIL-specific, successful modeling, implementation, and output generation. On the other hand, wider extension in PIL coverage, supposition of potentially connected jurisdictions, and integration of different jurisdiction/applicable law recommendations have been identified to be fields of interest for future work.

While the first may be achieved by making use of the modeling and implementation method as well as by the information model developed and documented here, supposition and integration are considerably more challenging, since both bear a high level of complexity and uncertainty. When aiming at a comprehensive, potentially even productive solution, however, the complete set of supposition (step 1 in Figure 3.3), PIL modeling, implementation, and output production (step 2), as well as integration of recommendations (step 3) has to be endorsed.

All four contributions addressed in this thesis have proven to be highly complex. In general, the way complexity was addressed in developing the modeling method, the information model, and in the implementation method reflects a "divide-and-conquer" approach. In modeling, the overall procedure was split into distinct steps for which each either guidelines or criteria could be determined. For instance, law selection was split into a pre-selection and detailed in-/exclusion sub-procedure so that complexity was better handled.

In the information model, the starting point was found in an existing ITSM model which was extended step-by-step. Again, this happened in order to accomplish a complex procedure. In the implementation, finally, a multi-step procedure focusing on different in- and output variables and predicates implementing partial paths (instead of complete paths) was adopted. The latter facilitates a partial debugging — reducing complexity considerably. These complexity issues lead to the question of how to mitigate such challenges. Three basic directions have been identified as follows:

**Status quo** — One way to handle complexity is to not do anything *fundamental* about it, but to cope with it as good as it gets. Coping means to, *e.g.*, extend both, modeling method and PIL coverage range, possibly with the help of jurists in order to lower potential for misinterpretation. In fact, this strategy is perceived as a pragmatic albeit inefficient and probably only symptomatic approach. Given the fact that territoriality and the respective political implications that come with it are not expected to diminish any time soon, a status quo approach constitutes a realistic option.

**Arbitration** — There are alternatives to judicial arbitration. Arbitration is a possible approach to so-called alternative dispute resolution. While alternative dispute resolution shows typically advantages in terms of flexibility and choice over judicial jurisdiction, it may as well turn out as complex as PIL, and enforcement might be a real problem in some cases. In conclusion, arbitration (and other alternative means) is difficult to assess with respect to trade-offs.

**PIL for international service business** — The Internet is one of the few truly global infrastructures. Electronic business in the Internet is happening now, and so are international service contracts concluded every day. The existence of a harmonized, widely accepted PIL specific to international service contracts in the Internet would mark a cornerstone towards making contracts in the Internet less of a "second-class" type of contract. Harmonization in PIL is perceived as the only way to address issues with the current approach at the root and in a sustainable manner. Therefore, it must be envisaged as a long-term objective.

Where minds of service providers, service customers, and policy makers might meet in the long run, is in an internationally harmonized PIL for commercially provided electronic services in the Internet. Such legislation, if drafted in consideration of the respective technical and legal requirements, may overcome those many challenges raised by today's territorial approach to Internet jurisdiction. It is safe to assume that any move in this direction will take time. On the other hand, it is perceived the only way to essentially and fundamentally foster legal certainty in electronic business in the Internet. This conclusion is irrespective of the DeRISC decision support system designed and implemented within the scope of this thesis. It would be of of help in modeling and implementing decision support for both contract

parties also if there was only a single PIL of relevance. The United Nations Convention on Contracts for the International Sale of Goods (CISG) [88] proves[1] that such an undertaking resulting in internationally harmonized law is feasible, in principle.

[1]For international sales of material goods, not for electronic services.

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# Appendix A

# Swiss Nominate Contract Type Terminology

Table A.1 lists for the set of Swiss nominate contract types the respective original terminology in German and French as defined by the Swiss Code of Obligations [18].

Table A.1: Swiss Nominate Contract Types with German and French Terminology

| Contract type | Original German terminology | Original French terminology |
|---|---|---|
| **Sale, change** | Kauf, Tausch | Vente, échange |
| **Gift** | Schenkung | Donation |
| **Rent, leasehold** | Miete, Pacht | Bail à loyer, bail à ferme |
| **Borrowing, loan** | Gebrauchsleihe, Darlehen | Prêt à usage, prêt de consommation |
| **Employment** | Arbeitsvertrag | Contrat de travail |
| **Work and labor** | Werkvertrag | Contrat d'entreprise |
| **Publishing** | Verlagsvertrag | Contrat d'édition |
| **Order** | Auftrag | Mandat |
| **Agency of necessity** | Geschäftsführung ohne Auftrag | Gestion d'affaire |
| **Commission** | Kommission | Commission |
| **Affreightment** | Frachtvertrag | Contrat de transport |
| **Procuration, Power of attorney** | Prokura und andere Handlungsvollmachten | Fondés de procuration et autres mandataires commerciaux |
| **Allocation** | Anweisung | Assignation |
| **Deposit** | Hinterlegungsvertrag | Dépôt |
| **Surety/bail** | Bürgschaft | Cautionnement |
| **Play and bet** | Spiel und Wette | Jeu et pari |
| **Annuity, prebend** | Leibrentenvertrag, Verpfründung | Rente viagère, contrat d'entretien viager |
| **Non-trading Partnership** | Einfache Gesellschaft | Société simple |

# Appendix B

# Swiss Federal Law on Private International Law

The Swiss Federal Law on Private International Law (IPRG) [19] governs three areas of interest. In international relations, it determines, whether Swiss courts or Swiss authorities have jurisdiction, it governs what law is applicable, and it constitutes rules of recognition and enforcement of foreign, *i.e.*, non-Swiss decisions [19], Art. 1.

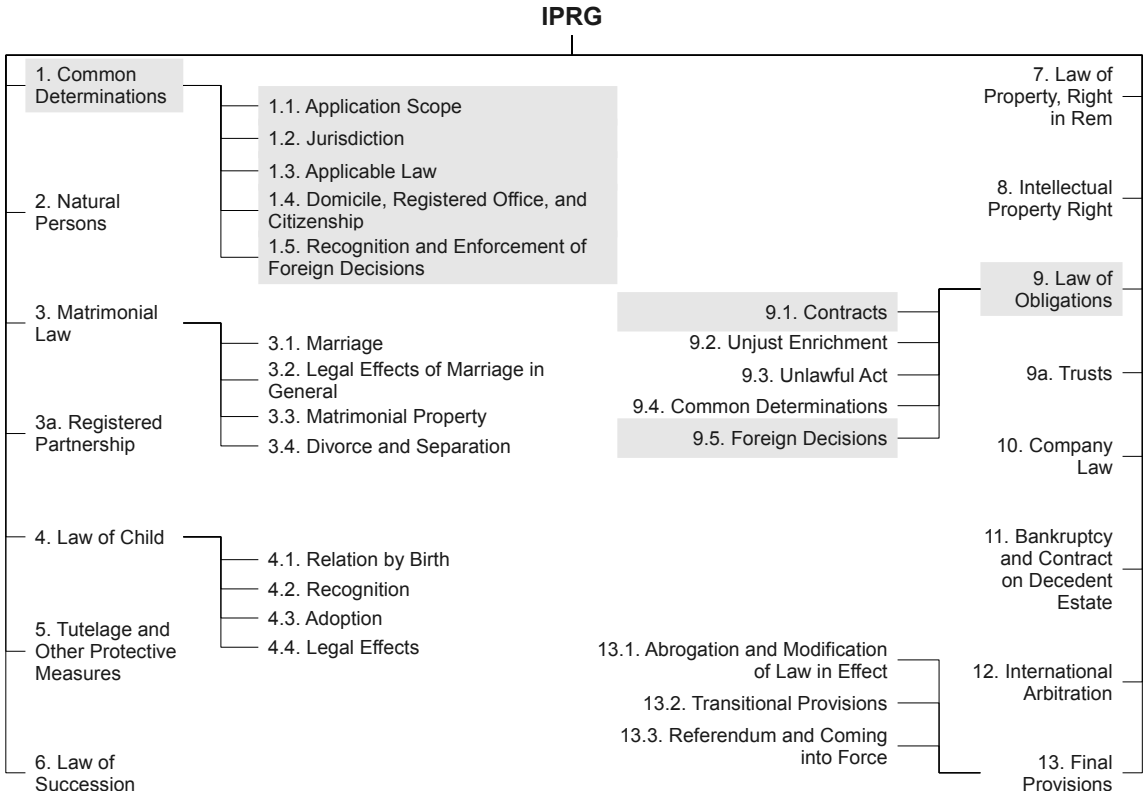


Figure B.1: IPRG Structure and Areas of Relevance (Gray Background)

The IPRG is structured into 15 chapters (*cf.* Figure B.1). Areas of relevance for this work are highlighted in Figure B.1 by means of a gray background. These focus areas comprise

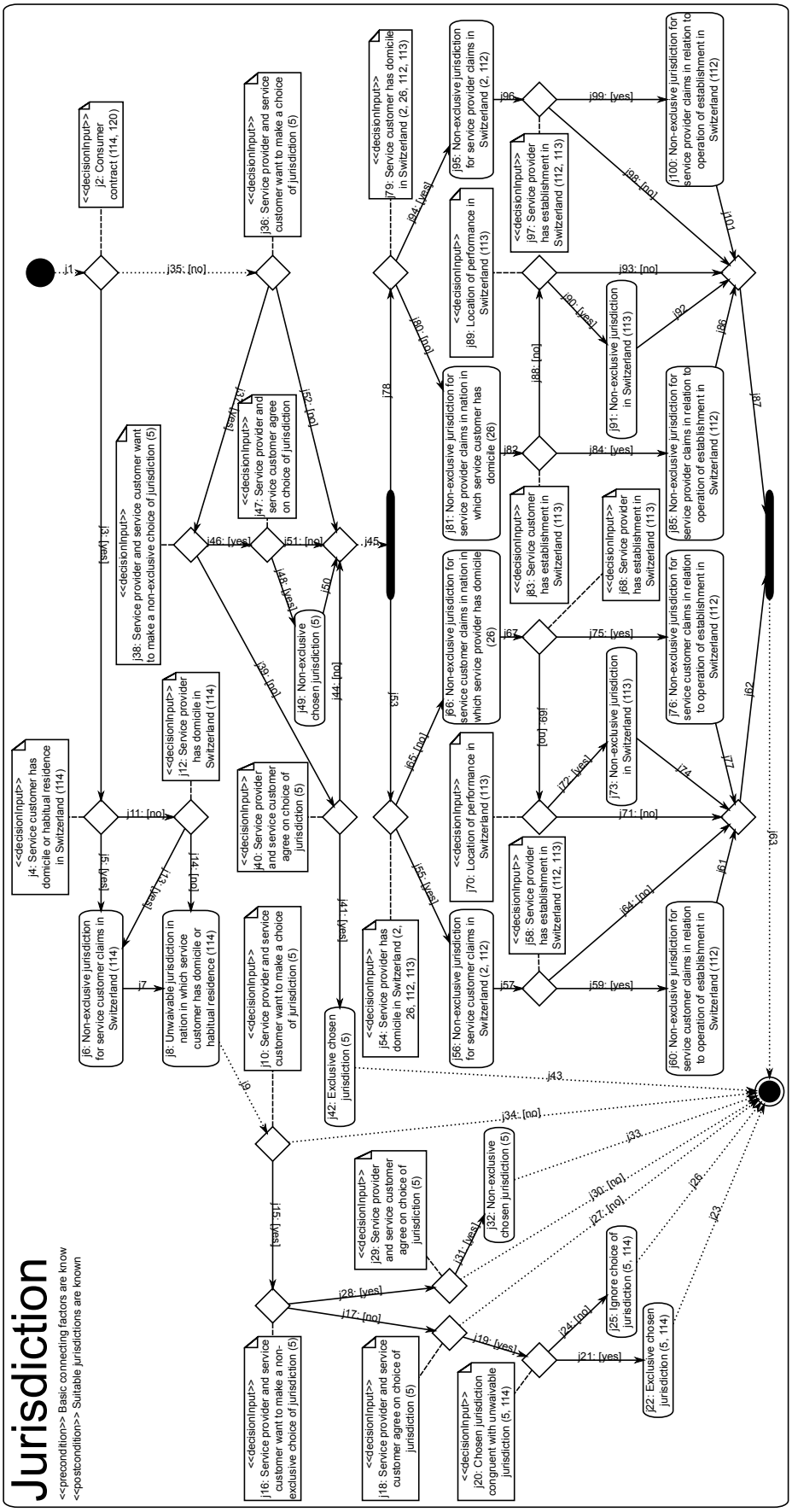


Figure B.2: Activity Diagram for the Question of Jurisdiction According to the IPRG

the chapter of common determinations and respective sections on contracts and foreign decisions of chapter 9 on law of obligations. The latter chapter — with regard to those sections mentioned — is relevant here, since it most directly reflects key aspects of jurisdiction and applicable law in international contracting. The first chapter is of relevance as it defines the IPRG's overall application scope, the applicable terminology as well as universal aspects of jurisdiction and applicable law. Provisions on recognizing and enforcing foreign decisions are deemed relevant as long as they govern jurisdiction of foreign authorities. Those focused areas as introduced have been identified in accordance with the guidelines and criteria outlined for PIL selection and analysis. Figure depicts the accordingly modeled UML activity diagram for the question of jurisdiction as a result from applying the PIL modeling method documented in Chapter 6.

# Acknowledgments

This thesis has an interdisciplinary nature with a dedicated outreach from communication systems into Private International Law and partly into economics as well. Interdisciplinary work is challenging in many ways. Specialization, on the other hand, has been an acknowledged success factor of human kind for a long time. Still, I strongly believe that it is worthwile to take the effort and, once in a while, build bridges between domains by exploring diverse perspectives, methods, and approaches. This is especially true for research done at a university. I am very grateful to my doctoral supervisor Prof. Dr. Burkhard Stiller for giving me the freedom to pursue this dissertation. Burkhard, many thanks for your continuous support in all phases of this endeavor. I would also like to thank my co-supervisor Prof. Dr. Stefan Bechtold for his much appreciated advice and the respective comments from a jurist's point of view.

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# Curriculum Vitae

Martin Waldburger holds a Master of Science (MSc) degree which he received in 2004 from the University of Zurich. In the same year, he joined Prof. Dr. Burkhard Stiller's Communication Systems Group (CSG) at the University of Zurich in the position of an assistant and doctoral student. He participated in the European Union project "Access to Knowledge through the Grid in a Mobile World" (Akogrimo) and the "European Union Network of Excellence for the Management of Internet Technologies and Complex Services" (EMANICS). His research work is concerned with technical, legal, and business aspects of electronic service provisioning in multi-domain environments. In particular, he is focusing on research challenges in automated contract formation for value-added electronic services in an international context. Martin Waldburger currently works as a postdoc in the position of a senior researcher in the Communication Systems Group (CSG) at the University of Zurich. He is project manager of the Swiss national project "Accounting and Monitoring of AAI Services" (AMAAIS), and he is work package leader in the European Union Coordination Action "Socio-Economics Services for European Research Projects" (SESERV).